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## AMBLYOPIA EX ANOPSIA IN ADULT LIFE

LUTHER C. PETER, M.D.  
PHILADELPHIA

The connection of these cases with squint in childhood is traced; and the importance of training the fusion sense in early life is pointed out. From the Department of Ophthalmology, Graduate School of the University of Pennsylvania. Read before the Colorado Congress of Ophthalmology and Otolaryngology, July 24, 1931.

In former communications, I called attention to three groups of acquired amblyopia: First, amblyopia in cases of monolateral eso- or exotropia; second, amblyopia in adolescence and in adult life, with a history of squint in early childhood; and third, the type which is observed in adults without a history, or other evidence of squint in childhood. The first of these groups has received considerable discussion. The second and third types are largely overlooked. A careful analysis, from a visual field standpoint, reveals the fact that the amblyopia in each group has the same characteristics, and that those cases which are observed in adult life are acquired in early childhood and undergo little change throughout life.

Phases which are found in each group are: first, a central scotoma about three degrees in diameter, an enlargement of the blind spot of Mariotte, and a moderate contraction of the peripheral fields for form and color; second, a rather high hyperopic error with anisometropia as an outstanding feature; third, a subnormal fusion faculty, with varying degrees of depth perception; and finally, an hereditary strain of squint as a preceding factor, or the appearance of monocular esotropia in the offspring.

Although I propose to discuss principally the second and third groups, a brief statement of the accepted facts in amblyopia of monocular esotropia, as it is found in childhood, will lead to a better understanding of the same form of amblyopia, as it is observed in adult life.

In young children, the following facts have been pretty well established:

1. Lowered central vision of the squinting eye is accompanied by a small central scotoma about three degrees in diameter. The blind spot of Mariotte is slightly enlarged, and, in some instances, a finger-like projection towards the point of fixation is observed. The peripheral fields are slightly contracted.

2. Central vision is usually reduced to about 6/15 to 6/30.

3. Refraction reveals a high hyperopic error which usually is higher in the squinting than in the fixing eye.

4. The prevailing type of squint is monocular esotropia.

5. In a majority of instances, careful treatment will prevent its development; and in most instances, more active treatment of the same kind will restore normal vision if the training is practiced before the fifth year. Training later in life is not so successful.

6. By occlusion of the fixing eye, or by the use of atropine, both squint and amblyopia can be transferred to the fixing eye, during the first five years of life.

7. Amblyopia does not develop after the seventh year.

8. Fusion can always be demonstrated as present, but defective.

9. Unless the squint is corrected, the fight against amblyopia must be kept up until the seventh year.

10. Failure to correct this form of amblyopia is usually due to the fact that treatment is started after the

seventh year, an age too far advanced to expect anything but cosmetic results. There are exceptions to this last statement; first, in that there may be a rare possibility of an occasional congenital defect in the macula; and second, in that now and then, one can obtain brilliant results, in the form of perfect cures, in children over seven years of age.

11. In a majority of instances, one can trace the hereditary influence to the parents, or more remotely to other members of the family; to the presence of the same condition contemporaneously in brothers and sisters; and finally to the offspring.

12. A study of these cases supports our belief that the amblyopia of monocular squint is an acquired condition, and therefore the term amblyopia ex anopsia is the correct term.

The second group of cases, namely, monocular amblyopia in adult life with a history of squint in early childhood, includes a large number of cases. In this group, manifest squint may be corrected by refraction and by orthoptic training, with the addition of surgery in many instances. In a small group of patients, the squint disappears automatically, or spontaneously. Those who recover from manifest squint automatically, are few in number. In all cases of this type which have come to my attention, glasses were prescribed and worn during childhood. I have not observed an instance of spontaneous correction of the squint without the aid of glasses. The refractive error is of the same type which is observed in young cases of monocular esotropia—high hyperopia with anisometropia. A fair fusion faculty can be uncovered in most instances when the eyes are held in approximate parallelism. When there is a moderate degree of residual squint present, fusion is much impaired. In fact, if the cure is complete (amblyopia excepted), the fusion faculty is good and elastic with good depth perception. In such cases central vision is apt to be 6/15 to 6/12. Profound amblyopia is not observed when the eyes are manifestly straight.

A point of much interest is the mechanism by which fusion becomes strong enough to hold the eyes straight in the presence of amblyopia. If fusion is present, even in moderate degree, it is my observation that refraction with orthoptic training often paves the way for self education of fusion, providing the squint is moderate in degree—a squint of fifteen degrees. Furthermore, after early operation on children of three or four years, with squint of thirty degrees or more, I have observed the same results, namely, self education of fusion, after surgery was added to refraction and orthoptic treatment. In short, fusion, if present, is readily trained, resulting in a perfect cure of the squint in the fullest meaning of the term; and the child automatically trains itself to fuse, if it is aided by glasses and orthoptic training, by reducing the deviation to an angle which fusion is able to bridge.

The fusion areas of the retina are probably more extensive than we ordinarily believe, although one thinks only of the central macular area as concerned in fusion. This becomes quite evident in stereoscopic and amblyoscopic work. If the objects which aid fusion are large, the child finds it less difficult to fuse than when objects are small. The extent of the fusion areas in the retinae is, therefore, most likely responsible for the ability of the patient to fuse in the presence of a relative central scotoma three degrees in diameter.

Although the eyes to all appearances are straight, and by concentration, patients may give evidence of depth perception, it does not follow that binocular single vision is present. Suppression of the image in the amblyopic eye continues, and marked degrees of heterophoria can always be elicited without the asthenopic symptoms which accompany the same degrees of heterophoria in patients with normal central vision in each eye. If fusion is not exercised at all, a residual squint can always be uncovered, and in most instances, it is quite manifest.

My reason for stressing this large



A GROUP OF CASES TYPICALLY ILLUSTRATIVE OF AMBLYOPIA EX ANOPSIA IN ADULTS

Age	Refraction	Improvement	Central Scotoma
1. 25	+ 0.75 C. ax. 80° = 6/5 + 4.00 S. = + 1.25 C. ax. 90° = 6/60	6/45	Yes
Squint present at 8 years. Disappeared at 9 years.			
2. 44	+ 0.62 S. = + 0.25 C. ax. 180° = 6/6 + 2.50 C. ax. 125° = 6/15		Yes
No squint. Eccentric nebula.			
3. 50	+ 1.00 S. = + 0.75 C. ax. 180° = 6/5 + 2.50 S. = + 1.75 C. ax. 142½° = 6/7.5 pt.		Yes
Squint present in childhood.			
4. 18	+ 4.50 S. = + 1.75 C. ax. 15° = 6/9 + 1.50 S. = + 1.25 C. ax. 142° = 6/5-2	6/5	Yes
No squint.			
5. 36	+ 1.00 S. = + 0.25 C. ax. 30° = 6/5 + 1.50 S. = + 0.25 C. ax. 150° = 6/15		Yes
No squint.			

Fusion faculty good in each instance.  
Training in cases 1 and 4.

group of cases of amblyopia ex anopsia with imperfect cures, is to call attention to the need for refined and systematic training of squint in the first five years of life, to reduce this only too numerous group of individuals. True enough, cosmetic cures relieve these patients of the embarrassment and sensitiveness incident to their deformity; but how can the economic loss to such individuals be estimated? How much has such amblyopia influenced the careers of men and women, even though the sting of the manifest deformity has been removed? From how many vocations are such individuals excluded? This second group of cases stresses the error of the advice to parents "to give the child a chance to grow out of the squint." If this advice is replaced by advice to correct monocular esotropia before the age of five, this second group of acquired amblyopia will be much reduced in number.

The third group of amblyopias from disuse differs from the first and second, in two essential respects. In the first place, there is no evidence of squint at any time in the history of the case; and in the second instance, fusion seems to be fairly well developed in most instances. Although parents may protest any knowledge of squint in childhood, it is not unlikely that squint of moderate degree may have been present, but unrecognized. At least one

case of this character has fallen under my care, in a child of twelve whose parents claimed compensation because of the alleged sudden appearance of strabismus after an automobile accident. Amblyopia ex anopsia of marked degree, with its usual characteristics, was uncovered after the accident. The recognition of the same and the absence of atrophy, became medicolegal factors, which manifestly decided the case against the plaintiff, and correctly so. The moderate degree of squint was not recognized by the parents, and they were equally unaware of the existence of the amblyopia, until the accident led them to a closer observation of the real condition as caused possibly by the accident. In this instance, the mother was a victim of the same form of squint. Such cases would naturally fall into the second group. There are, however, a number of instances in which the negative history of squint is well authenticated. Central vision, as a rule, is fair; 6/12 to 6/15. It is better obviously than in many cases in early life, in which fixation has become difficult, because confirmed monocular squint has remained uncorrected for a number of years. Fusion is sufficiently active to keep the amblyopic eye in more or less active function; and vision, therefore, is not reduced to the low levels sometimes found in the first group.

A test of the fusion faculty demon-

strates a moderate degree of activity, if large objects are used, and the extramacular areas are included in the fusion test. If small objects are used, the amblyopic eye fails to record, or to respond to impressions; and suppression of the image is the result. Because of subnormal macular sensitivity and weak fusion power, a hyperexophoria may be uncovered, or occasionally a hyperesophoria. In my experience the presence of the latter suggests the probability, that esotropia at one time existed, but was not recognized. The usual type is hyperexophoria. In this respect, the eyes follow the usual tendency found in middle or late adult life.

From an etiologic standpoint, the presence of the usual high hyperopia, with pronounced anisometropia, is most significant. Given an unequal refractive error of considerable degree in childhood, with weakly developed fusion, the habit of suppression of the indistinct image or more correctly speaking, the ignoring of this image, leads to convergent monocular squint. If fusion is normal in the same type of case, the habit of suppression may be just as active, but the eyes continue to hold in alignment, and squint does not develop. The extramacular fusion areas help to keep fusion active, and the macula itself, in all probability, shares to the extent to which its subnormal sensitivity permits.

One would naturally expect the amblyopia to become more profound with advancing years. On the contrary, central vision, in most instances, remains stationary. The degree of visual loss is established very early in life. If profound in early life, and uncorrected, it continues so throughout life. In fact, few cases of marked loss of central vision recover from the squint, unless operative measures are practiced. It is quite likely, therefore, that only cases of moderate degrees of amblyopia are found in this third group of cases. The preservation of parallelism and the moderate activity of the fusion faculty are the two factors which, in all probability, are the basic reasons why amblyopia is not profound.

In the matter of visual field disturbance, there are also slight digressions from that which is found in groups one and two. The central scotoma is the same, but less profound. The blind spot is more apt to be within normal limits, barring the finger-like projection, and peripheral fields are apt to be full. The finger-like projection from the blind spot can often be uncovered. It is difficult to explain this interesting phenomenon. Inasmuch, however, as it is uncovered in other conditions, it is not improbable that the great number of macular fibers which are located in this area is in part responsible for a moderate degree of insensitivity, when test objects of low visibility are used, and it is only by means of minute test objects that the projection is uncovered.

The otherwise normal limits of the blind spot and full peripheral fields are easily explained. As in the child with manifest squint, in adults in whom the squint is corrected by operation, the central amblyopia continues, as the latter is only a cosmetic cure. Non-use renders this area less responsive. In children in whom real cures are brought about, normal sensitivity is restored in the macular area and in all parts of the retina. In the adults included in the third group, suppression, if present at all, is negative in character and not positive. Furthermore, inasmuch as the two eyes function as one, at least to the same extent as is probably observed in other forms of heterophoria, retinal sensitivity is probably normal throughout, excepting in the macular area. Peripheral fields, therefore, are often full and the blind spot is often normal in outline.

Finally, there is something to be said as to the degree of the amblyopia, and its curability or improvement in middle and late adult life. As previously stated, profound amblyopia usually argues for squint in early childhood, accompanied by marked lowering of central vision. On the other hand, in my experience, central vision is fairly good in a majority of instances of genuine amblyopia without squint. Little has been attempted in its cor-

rection in adult life; and, in all probability, little could be accomplished by ordinary means. A few instances, however, of return of useful vision after the loss of the fellow eye have been brought to my attention. In both instances, the verbal report was ability to read newspaper print, after several months of persistent effort on the part of the patient. It is probable, therefore, that inasmuch as the amblyopia is not profound in the latter group of cases, enforced use, after total visual loss in the other eye, may yield fair if not perfect vision. What is obviously a safer deduction is the thought that proper effort to detect and correct such amblyopia in early life will meet with the same success which one can obtain in early childhood in the amblyopia of manifest squint.

The cases from which I have drawn

my conclusions as to amblyopia in adults were mostly observed in adult life; but the amblyopia was present, according to the history of the patients, during adolescence. The majority of these cases either show a low degree of residual squint, or upon careful questioning, a history of squint which disappeared *after the wearing of glasses*. A smaller number were quite positive that they did not have squint at any time.

While macular loss of vision is not so vital to the patient as total visual loss, a greater degree of alertness on our part, to recognize and properly appraise this condition early in life, is the best way to contribute to a constructive program in the prevention of defective vision in a very large group of cases.

1930 Chestnut street.

## SURGERY OF THE INNER CANTHUS AND RELATED STRUCTURES

V. P. BLAIR, M.D.

J. B. BROWN, M.D.

AND

W. G. HAMM, M.D.

SAINT LOUIS

Correction of deformities in the region of the inner canthus either congenital or traumatic in origin presents a complex problem. The canthus may be displaced outward, downward, or backward, or it may be distorted. Lacrimal drainage may be disturbed. Methods of correcting these defects are illustrated by photographs of patients so treated and by diagrams and descriptions of the operative procedures. From the Department of Surgery, Washington University School of Medicine, St. Louis. Read by Dr. Blair before the Chicago Ophthalmological Society, October 19, 1931.

There are anatomical relations and constituents at the inner canthus that make corrective surgery more complex here than in any other part of the ocular appendages. Familiarity with the surgical significance of these is an item in the equipment of the ophthalmologist, but the general surgeon who blunders into this field is apt to get his orientation partly through jolts and disappointments. Our own experience has been gained through that more haphazard approach, and, possibly for this reason, repairs made here have presented interesting difficulties. Without pretense to knowledge that would warrant a formal dissertation we will sketch in outline several different clinical conditions affecting this area which we have attempted to treat, though some of these will bear about as much inter-relationship as might different incidents recounted at the same break-fast table.

The inner canthus is a rather fixed point held in the depth of the naso-orbital valley by the palpebral fascia and the internal palpebral ligament. The inner extremity of the latter divides into a "Y" or loop attached anteriorly to the frontal process and behind to the lacrimal bone, embracing the lacrimal sac (see legend, Fig. 1). This fixation of the canthus in the depth of the naso-orbital valley along with the intimate relationship of the canthus to the mechanism of lacrimal drainage both demand special consideration.

**Displacements.** If the fixation is lost, then muscular pull may carry the can-

thus outward (Fig. 2), scar contraction may distort it (Fig. 7), and the normal elasticity of the surrounding tissues can pull it forward. The position of the canthus will also change with any displacement or abnormality of related bone (Figs. 3 and 4), and, while the commissura remains fixed, either dis-

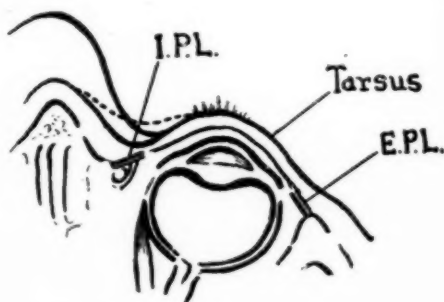


FIG. 1 INTERNAL PALPEBRAL LIGAMENT

A diagrammatic coronal section of the orbit at the level of the inner canthus showing the wide attachment of the internal palpebral ligament (I.P.L.) to the frontal process and the lacrimal bone, and enclosing the lacrimal sac. The dotted line extending from the prominence of the eyelid over to the nasal bridge indicates the shallowing of the valley that may occur with the loss of ligamentous and fascial fixation at the inner canthus.

tension of the lacrimal sac, hernia of the orbital fat, or a tumor may cause an unnatural fullness of this area; and scar can displace the adjacent lid edges or surfaces sufficiently to hide or distort its natural lines (Figs. 6 and 12). Congenitally, the normal distance between the two orbits may be increased,



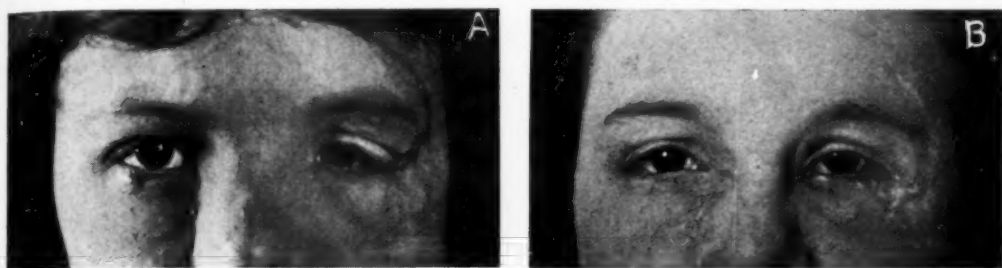


FIG. 2. TRAUMATIC OUTWARD DISPLACEMENT OF THE CANTHUS, ENOPHTHALMOS, ETC.

Injured five months previously in an automobile accident. The nasal bones were flattened and spread laterally. There were facial scars, obstruction of the left lacrimal sac, left enophthalmos, and bony displacement about the left orbit. Vision was slightly less on left side but the ophthalmoscopic picture was normal. There was lessened power of the extrinsic muscles due at least partially to the enophthalmos.

The obstructed lacrimal sac was removed with a surrounding mass of scar; a wedge-shaped flap, with its base above the outer canthus, was switched into the left lower lid after building up the lower orbital border with cartilage. At another operation the inner canthus and the fissure were moved medially four millimeters by a crescent excision and suture, combined with building up of the outer border of the orbit, and the nasal bridge with cartilage. The enophthalmos was overcome by implanting deeply a mass of cartilage along the floor of the orbit. The size of this implant was determined by building out the left orbit with modeling clay until it corresponded with the right side. The clay used to do this was then removed and remodeled into a shape approximating an intra-orbital insert. With this as a pattern the cartilage was cut to approximately the same size.

B shows the appearance some months later. Further correction about the left nostril is needed.



FIG. 3. TRAUMATIC OUTWARD DISPLACEMENT WITH OBSTRUCTION AND SUPPURATION OF LACRIMAL SAC

A shows a smashing and outward displacement of the nasal bone and nasal process of the maxilla on the right side only, causing a transverse shortening of the palpebral fissure, an epicanthus, and a bulging all the way down the right side of the nose. In addition to this there was obstruction and suppuration of the lacrimal sac. The correction here consisted in opening the original scar, removing the lacrimal sac and the upper part of the nasal duct and chiseling out the displaced bone. Because the left side of the nose and canthus were intact the through and through fixation of the following case was avoided and the fixation suture was passed through a drill hole in the edge of the nearest available bone, the bony wall of the nasal cavity at and above the level of the canthus having been entirely removed in the correction. This may account for some of the downward displacement of the right canthus and inner half of the lids which can be rather simply corrected at a later period.



FIG. 4. TRAUMATIC BONY DISPLACEMENT OF THE INNER CANTHI

Eight months previously sustained a crushing injury between eyes. There was slight backward displacement and widening of the upper part of nasal bridge with marked outward displacement of both mesial orbital borders and corresponding displacement of the inner canthi, and transverse shortening of the palpebral fissures. The tarsal border of the inner half of each upper lid, when the fissures were open, curved acutely down to the displaced inner canthus (see *A*).

Among other corrective operations, the changes shown in *B* were obtained by elevating the periosteum and with it the lacrimal sacs from the mesial wall of the orbits through semilunar incisions made medial to the inner canthi. With a gouge, the nasal bones, the nasal processes of the maxillæ and lacrimal bones, were chiseled out to give the bony bridge proper width. This exposed the nasal mucous lining and the canthi were drawn into proper relation by a piece of 40-day 00 chromic catgut threaded on a fine surgical needle 4 cm. long, which entered the right inner canthus near the lacus reflection, trans-fixed the nasal cavities at the proper level, and emerged from the left canthus at a point corresponding to entrance of the needle on the right side. The needle reentered at the inner extremity of the left canthus, retraversing the nasal fossæ and septum, and emerged from the inner extremity of the right canthus. By tying the two ends the inner canthi of both eyes were drawn to approximately their proper positions as shown in *E*. No immediate obstruction of lacrimal drainage occurred, but a letter later stated that some tearing had developed subsequently but had ceased on one side and was improving on the other.

Note that the vertical wrinkling of the infraorbital skin in *A* shown best in the uninjured cheek has been corrected by this procedure as shown in *B*.

or the inner canthi may be displaced outward with a transverse shortening of lids and fissures, or the commissura may be displaced downward (Figs. 8 and 9).

**Correction of outward displacement.** If the lids are sufficiently lax and there be no forward displacement, then a crescentic or arrowhead excision and suture of structures superficial to the lacrimal sac may be sufficient. When needed, releasing incisions may be

added, but deep scarring might require the simultaneous excision of the lacrimal sac (see legend, Fig. 2). Some relaxation can be obtained by cutting the external palpebral ligament, to be followed by a canthotomy if needed. A simple internal canthotomy would seem contra-indicated in the presence of normal lacrimal drainage and in any case would give an unnatural appearance.

Correction of true outward displace-

ment, due to bulging or distortion of the inner border of the orbit, requires adjustment or removal of bone, though an apparent displacement may be relieved by raising a very flat nasal bridge, and the true congenital type

can be camouflaged by giving more slope to the bony walls of the nasal bridge.

With the loss of its proper anchorage, the tendency for the canthus to come forward may become more evi-

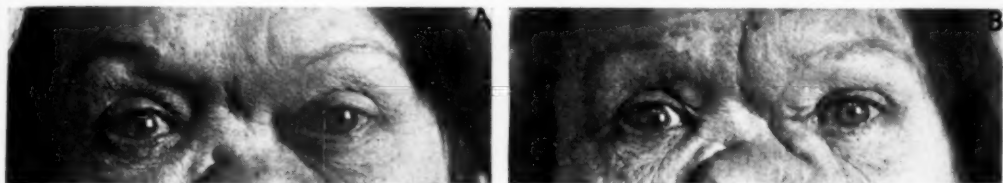


FIG. 5. TRAUMATIC BACKWARD DISPLACEMENT

In this case the bringing forward of the canthus was done preliminary to the correction of other displacements. Through a vesiclectomy incision the attachments of the palpebral ligament at both the frontal process and lacrimal crest were cut and the lacrimal sac was freed from the bone and lifted out from its groove and brought forward together with the canthus. To prevent kinking at its junction with the nasal duct, the part of the maxilla carrying the latter was pried forward with a chisel inserted through the nose. Examining *B* it will be seen that while the canthus has been moved forward, the cutting of its anchorage has also allowed it to move outward. This could be best taken care of after the restoration of the bridge of the nose.



C



D

FIG. 6. TRAUMATIC DOWNWARD DISPLACEMENT OF INNER CANTHUS

Received several cuts two years previously in auto accident one of which caused right inner canthus to become distorted and drawn downward.

There was a scar from the right inner canthus extending downward to the nose and lip. Inner ends of both tarsal borders and lids were drawn downward as shown in *A*. Lower canaliculus was divided and obstructed. Apparently the tears were all syphoned off through upper punctum as there was no excess in the conjunctival sac.

The correction shown in *B* was attained by excising the scar that pulled the inner canthus down and switching the flap "a" in *C* to the position shown in *D*. A more natural configuration could be obtained but the patient states that he is comfortable and satisfied, and desires that nothing further be done.

Examining *C*, the thought comes that with these incisions, one ought to have succeeded in bringing the inner canthus further toward the midline and giving it better slope, but this might have been at the risk of damaging a functioning canaliculus.

Also there were extensive repairs of the ala, tip, and columella of the nose made at this same operation, and the time element was a consideration.

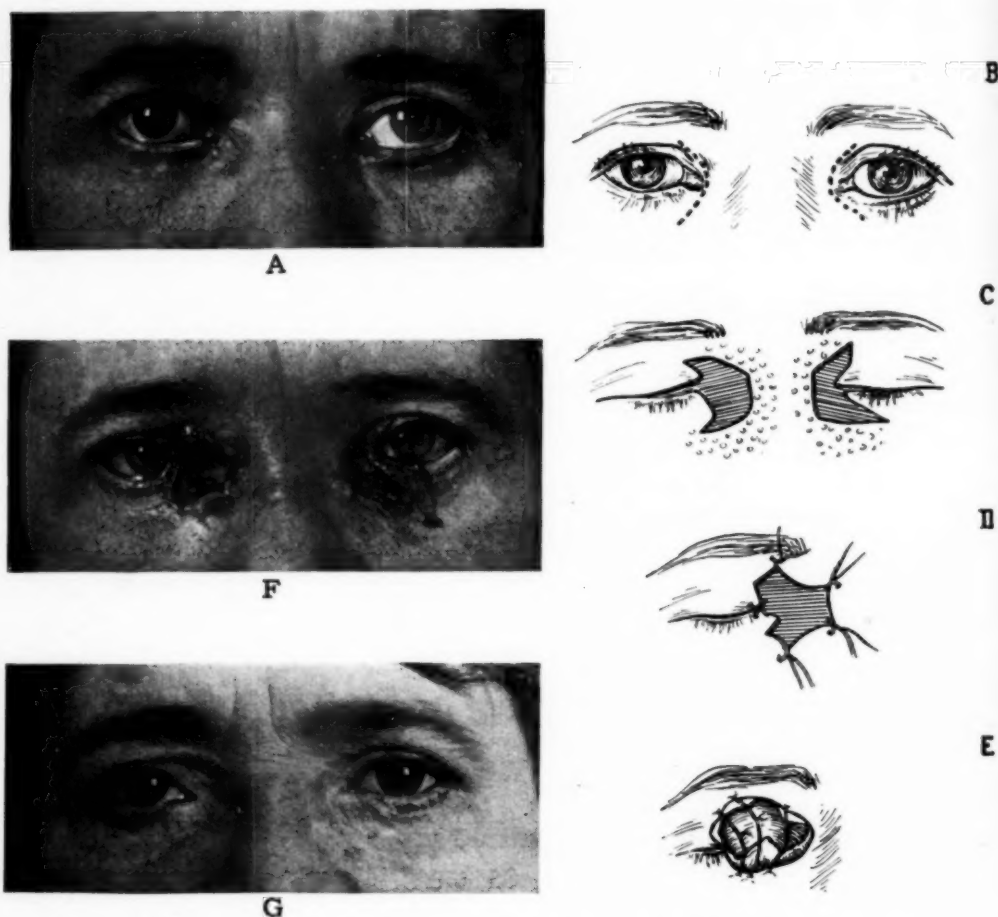


FIG. 7. TRAUMATIC DISTORTION OF CANTHI AND DISPLACEMENT OF THE PUNCTA

Had operation for puffiness of the lower lids which required two months for healing. This was followed by a feeling of discomfort and excessive tearing.

The width of the lacus was increased, the puncta were not in contact with the globes, and the commissura on each side had been removed, leaving the mucosa directly continuous with the skin of the nose. The left lower lid border lacked contact for its inner two-thirds (see *A*).

Dr. W. F. Hardy, who was asked to probe the ducts and to check up on our findings, agreed that the tearing was at least partly due to the lack of punctal contact, but found that while he could inject fluid through all four puncta, he could pass a probe only through the right upper one, the others being constricted by scar.

The scar surrounding each inner canthus was dissected out through incisions shown in *B*. This apparently allowed the puncta to come into contact with the globe but left large raw areas, which in size probably approximated the amount of skin removed at the original operation, and destroyed the continuity of the tarsal borders at the inner canthi (see *C*). To correct this latter, the inner end of each lower tarsal border was sutured to the one above (see *D*). This figure also shows the location of stay sutures put in over wax forms, each carrying a split graft.

*E* shows the wax for the right canthus in place with the excess graft protruding.

*F* shows the condition 14 days after the placing of the grafts, and at this time the graft that bridged over the inner end of each fissure was cut and some adjustment made of the scar border.

*G* shows condition 11 months after placing grafts. At this time the tearing and the strained feeling about the eyes had been relieved, but there was still a perceptible ridge at the junction of the graft with the nasal skin. This was removed later and resutured on each side.



dent upon an effort to correct an outward displacement. To overcome this we have attempted a makeshift for the missing ligament (Fig. 4).

Where necessary, bone must be removed or replaced, as must herniated fat. Distorted scars should be released or removed and the missing tissue replaced.

An apparent forward displacement can result from loss of skin internal to the canthus, and can be corrected by restoration of the loss. If the loss involves a considerable depth of tissue or the full or nearly full thickness of the lids, it can be best replaced by a pedicle flap. A shallow or surface loss is better repaired by a free skin graft.

On account of its more natural texture and color, the full thickness graft

is preferable, where it is to rest in an area surrounded by more or less fixed tissue, as on the side of the nose (see legend, Fig. 12). If, on the other hand, the defect is of any considerable size, the graft is to be placed on a movable base that can subsequently yield to the drawing force of the underlying scar, then a free split graft fixed on a wax form that will allow for forty or sixty percent subsequent contraction is the more suitable (see legend, Fig. 7).

**Downward displacement**, real or apparent, congenital or acquired, is usually most surely corrected by switching a flap from above to below the canthus (see legend, Figs. 8 and 9), but in a few, simply shifting of the outer lip of the vesiculectomy incision is sufficient.



FIG. 8. CONGENITAL MALFORMATION OF THE INNER CANTHI WITH ABSENCE OF NASAL DUCTS AND NOSE

Nineteen year old boy who was born with neither external nasal passages nor any of the accessory nasal sinuses.

In cases of congenital absence of half of the nose, the down turn of the inner canthus on that side is characteristic. In addition there is usually a tubercle above the canthus which probably represents the point of attachment of a process similar to that shown and described under figure 10. In this case of absence of the entire nose both inner canthi were turned down but the tubercles were absent (see A).

There was excessive tearing and, as a preliminary step to the establishment of a nasal breathing passage and of an external nose, both blind lacrimal sacs were removed and the canthi raised by switching a triangular flap from each upper lid to below the canthus.

B shows the change in the canthi and the external nasal restoration. He now has free nasal respiration which has improved his health and comfort.

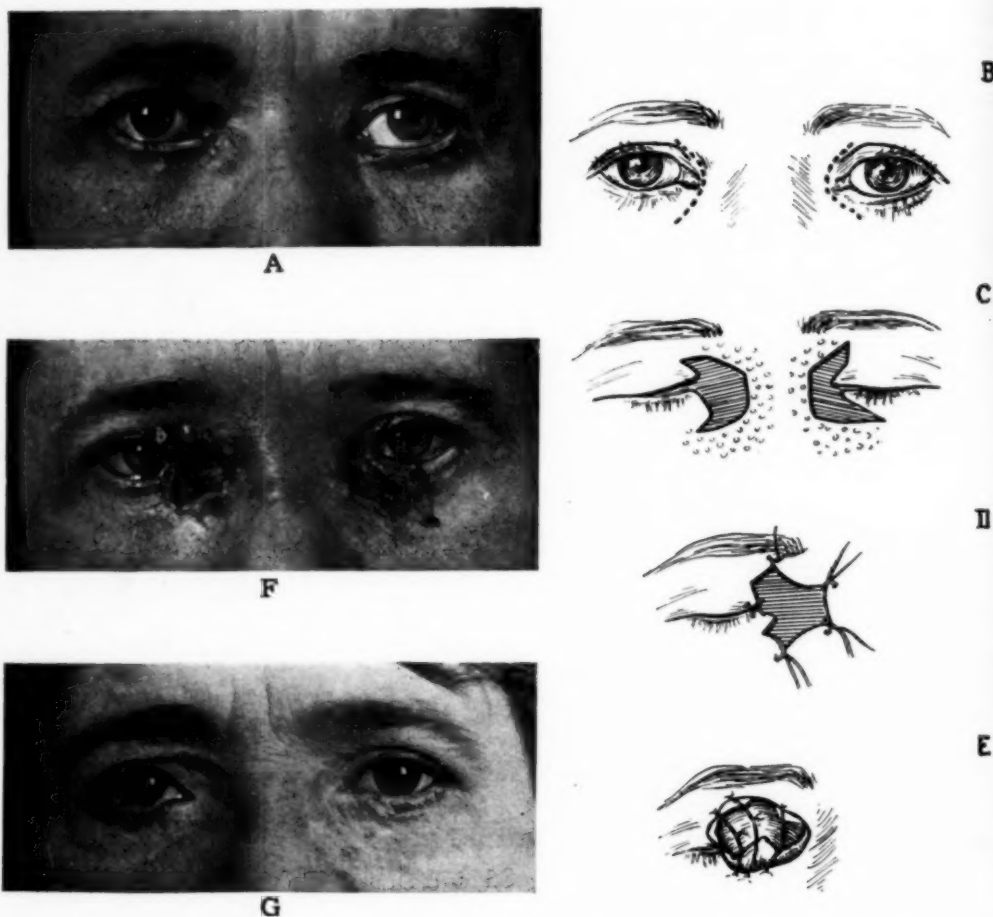


FIG. 7. TRAUMATIC DISTORTION OF CANTHI AND DISPLACEMENT OF THE PUNCTA

Had operation for puffiness of the lower lids which required two months for healing. This was followed by a feeling of discomfort and excessive tearing.

The width of the lacus was increased, the puncta were not in contact with the globes, and the commissura on each side had been removed, leaving the mucosa directly continuous with the skin of the nose. The left lower lid border lacked contact for its inner two-thirds (see A).

Dr. W. F. Hardy, who was asked to probe the ducts and to check up on our findings, agreed that the tearing was at least partly due to the lack of punctal contact, but found that while he could inject fluid through all four puncta, he could pass a probe only through the right upper one, the others being constricted by scar.

The scar surrounding each inner canthus was dissected out through incisions shown in B. This apparently allowed the puncta to come into contact with the globe but left large raw areas, which in size probably approximated the amount of skin removed at the original operation, and destroyed the continuity of the tarsal borders at the inner canthi (see C). To correct this latter, the inner end of each lower tarsal border was sutured to the one above (see D). This figure also shows the location of stay sutures put in over wax forms, each carrying a split graft.

E shows the wax for the right canthus in place with the excess graft protruding.

F shows the condition 14 days after the placing of the grafts, and at this time the graft that bridged over the inner end of each fissure was cut and some adjustment made of the scar border.

G shows condition 11 months after placing grafts. At this time the tearing and the strained feeling about the eyes had been relieved, but there was still a perceptible ridge at the junction of the graft with the nasal skin. This was removed later and resutured on each side.

dent upon an effort to correct an outward displacement. To overcome this we have attempted a makeshift for the missing ligament (Fig. 4).

Where necessary, bone must be removed or replaced, as must herniated fat. Distorted scars should be released or removed and the missing tissue replaced.

An apparent forward displacement can result from loss of skin internal to the canthus, and can be corrected by restoration of the loss. If the loss involves a considerable depth of tissue or the full or nearly full thickness of the lids, it can be best replaced by a pedicle flap. A shallow or surface loss is better repaired by a free skin graft.

On account of its more natural texture and color, the full thickness graft

is preferable, where it is to rest in an area surrounded by more or less fixed tissue, as on the side of the nose (see legend, Fig. 12). If, on the other hand, the defect is of any considerable size, the graft is to be placed on a movable base that can subsequently yield to the drawing force of the underlying scar, then a free split graft fixed on a wax form that will allow for forty or sixty percent subsequent contraction is the more suitable (see legend, Fig. 7).

**Downward displacement**, real or apparent, congenital or acquired, is usually most surely corrected by switching a flap from above to below the canthus (see legend, Figs. 8 and 9), but in a few, simply shifting of the outer lip of the vesiculectomy incision is sufficient.



FIG. 8. CONGENITAL MALFORMATION OF THE INNER CANTHI WITH ABSENCE OF NASAL DUCTS AND NOSE

Nineteen year old boy who was born with neither external nasal passages nor any of the accessory nasal sinuses.

In cases of congenital absence of half of the nose, the down turn of the inner canthus on that side is characteristic. In addition there is usually a tubercle above the canthus which probably represents the point of attachment of a process similar to that shown and described under figure 10. In this case of absence of the entire nose both inner canthi were turned down but the tubercles were absent (see A).

There was excessive tearing and, as a preliminary step to the establishment of a nasal breathing passage and of an external nose, both blind lacrimal sacs were removed and the canthi raised by switching a triangular flap from each upper lid to below the canthus.

B shows the change in the canthi and the external nasal restoration. He now has free nasal respiration which has improved his health and comfort.



FIG. 9. CONGENITAL DISTORTION OF CANTHUS, HALF NOSE AND DEFORMED GLOBE

This apparently was not a true half nose as there was a small part of the vestibule and the ala present on the left side (see *A*). Notice the scar well above the inner canthus which may represent the previous attachment of a body similar to that shown in figure 10. The canthus pointed downward and inward in a characteristic fashion. Pus could be expressed from the puncta. The globe had a small iris and the pupil was indistinct. It is not our practice to make a nose until the face has attained nearly its full growth, but the lacrimal sac was excised, and three months later the inner canthus was brought approximately to its normal position by switching flap as shown in *C* and *D*.

*B* taken shortly after this operation shows the new position of the canthus.

**Backward displacement** is a rare condition that may accompany crushing-in of the frontal process and of the lacrimal bone (Fig. 5).

**Distortion.** The canthus can be too narrow from loss or adhesions in the conjunctiva. It can be widened from scar pull (see legend, Figs. 6, 7, and 12), paralysis, or from congenital deformity (Fig. 10).

The canthus distortion may be part of a widespread injury. Besides the unnatural appearance, these distortions may cause a feeling of discomfort, or interfere with siphonage of tears.

**Loss.** The destruction may be confined to the neighborhood of the canthus, or the contents of the orbit and its appendages may be destroyed (see legend, Fig. 11).

**Lacrimal Drainage.** As already pointed out, the canaliculi, the lacrimal sac and the nasal duct have a close surgical as well as anatomical relationship to the internal canthus.

If one good punctum with an open canaliculus can be brought into contact with the globe, drainage into the sac is usually satisfactory (see legend, Fig. 7).

After numerous consultations and some observations we have come to the conclusion that removal of the lacrimal sac is the most expeditious procedure in every case of chronic complete obstruction of lacrimal drainage, giving symptoms, and in which a competent ophthalmologist can neither pass a probe nor inject fluid through the nasal duct. It is more certain than



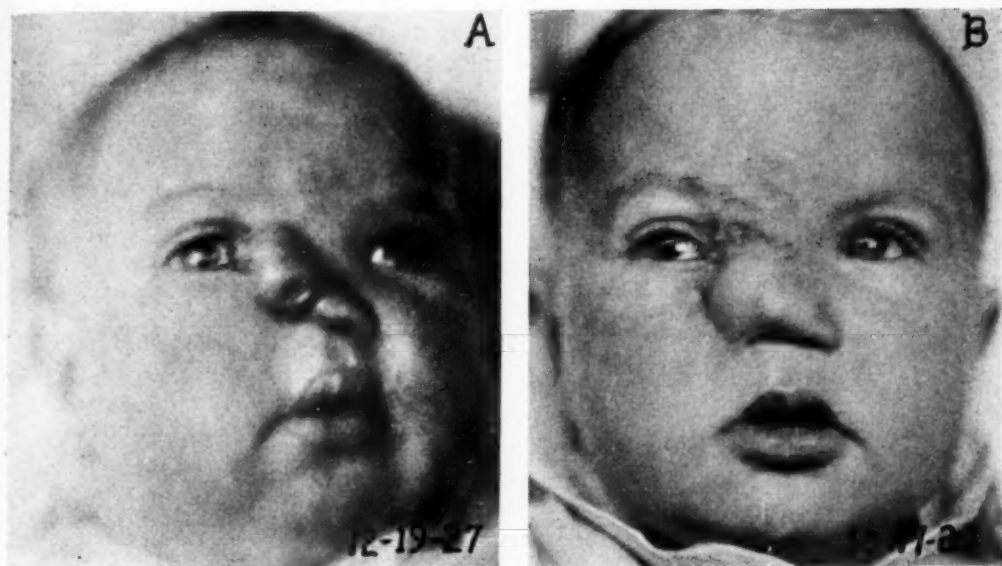


FIG. 10. CONGENITAL MALFORMATION AT INNER CANTHUS WITH BIFID NOSE

Had apparently normal left half of the nose. On the right side arising from a point just above the internal canthus was a fleshy cylinder 1.5 cm. in diameter and 2 cm. long which felt as if it were stiffened with cartilage in its lower half. In the under surface was an opening from which a clear watery fluid escaped. At operation it was found that this contained an expanded mucous-lined cavity which possibly represented the vestibule of the nose. There was some malformation of the iris (see *A*).

In attempting to remove the lacrimal sac we encountered a large blind pus-filled sac that probably represented much of the nasal passage of that side. Most of this was removed and an apparently successful nasopharyngeal drainage was provided for its posterior expansion. An attempt was made to utilize the mucous-lined, fleshy appendage in the restoration of the right half of the nose (see *B*).

When the child attains full or nearly full growth, further surgical correction will be indicated.

attempts to reconstruct the damaged passages, and has in our hands apparently given rather uniformly satisfactory results. For any other purpose than to eliminate a chronically diseased, infected focus, removal of a lacrimal sac would not be a logical procedure if it were not for the possibility that complete elimination of the sac has some reflex or some other inhibitory action on the secretion of the lacrimal gland. Observation of these cases before and after vesiculectomy strongly suggests some such action. From the annoying condition of almost constant tearing, the average patient from whom one or both sacs have been completely removed, has experienced either great improvement or relief closely resembling natural conditions. Most of the cases we see are either of congenital or traumatic ori-

gin (see legends, Figs. 3, 4, 9, and 10). Removal is facilitated and its completeness made more certain when it is possible previously to distend the sac with a fairly strong solution of methylene blue. By this means it was demonstrated at operation in one case that the obstruction was well down in the nasal duct and the patulous part above this was removed after rongeur-ing away the overlying wall of bone. In those cases in which a fistulous opening was found to communicate with an infected ethmoid cell, a free opening was made into the nose, the cell eliminated, and the sac removed.

Occasionally we have found it necessary to remove a scar-surrounded but draining sac, as a preliminary to corrective surgery of this area.

*Metropolitan building.*

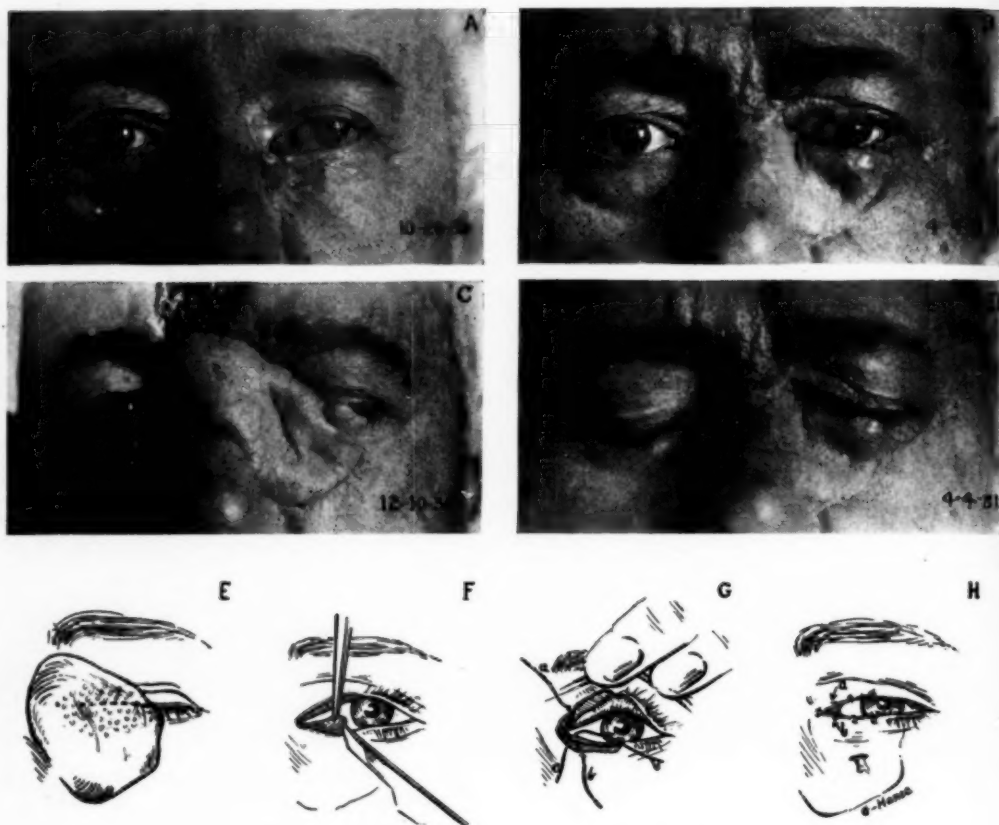


FIG. 11. LOSS AT THE INNER CANTHUS

For 30 years had repeated operations and radium treatments for what was presumably a basal cell epithelioma near the inner canthus.

Over an area 2.5 cm. in diameter, involving the inner half of both lids, and the side of the nose, the skin had been changed or destroyed, was scarred over and in places crusty. The inner end of the fissure was widened and part of the lining of the lower lid destroyed. The globe was movable, but the lacus was damaged.

On account of the danger of stimulating a recurrence if the scarred tissue were cut into, it was completely removed down to the periosteum on the side of the nose, down to the conjunctiva and the inner half of the upper lid with much of the full thickness of the inner half of the lower lid. The conjunctiva of the lacus was also removed over to its reflection onto the globe. Previous to this, however, a forehead flap had been prepared under the distal end of which had been implanted a split skin graft after thinning the flap as much as seemed safe. Then two months had been allowed for the restoration of circulation and for contraction of the skin graft.

Immediately after removing the scar as previously described, the end of the forehead flap was fitted into the defect, retaining as much of the skin graft on its under surface as was needed to replace the lost conjunctiva. The part that was to serve for the lacus was raised to form a tongue-shaped flap the free end of which was sutured to the cut edge of the ocular conjunctiva.

C shows this flap down in place and also the raw surface on the forehead from which it was taken. One month after it was transferred, the pedicle was cut and returned to the forehead, the remaining defect being covered with a split skin graft. Three months' time was allowed to pass between inserting the flap and cutting the palpebral fissure. By this time the edema had disappeared, the flap had softened, and the circulation was sufficiently well established to permit of the removal of subcutaneous tissue, necessary for the thinning of the lid part proper, E, F, G, and H. A month after this flap was first put in place, the globe was so fixed by the lacus skin graft that it could not rotate externally beyond the midline, but three months later the excursion had increased so that he did not notice any double vision though at this time the outward excursion was only four millimeters. This should increase with further time. B and D show the condition four days after the

fissure was cut and the flap was thinned. Later further adjustment will be needed to shorten the transverse width of the upper lid and to lengthen vertically its inner part. There is enough material present to do this.

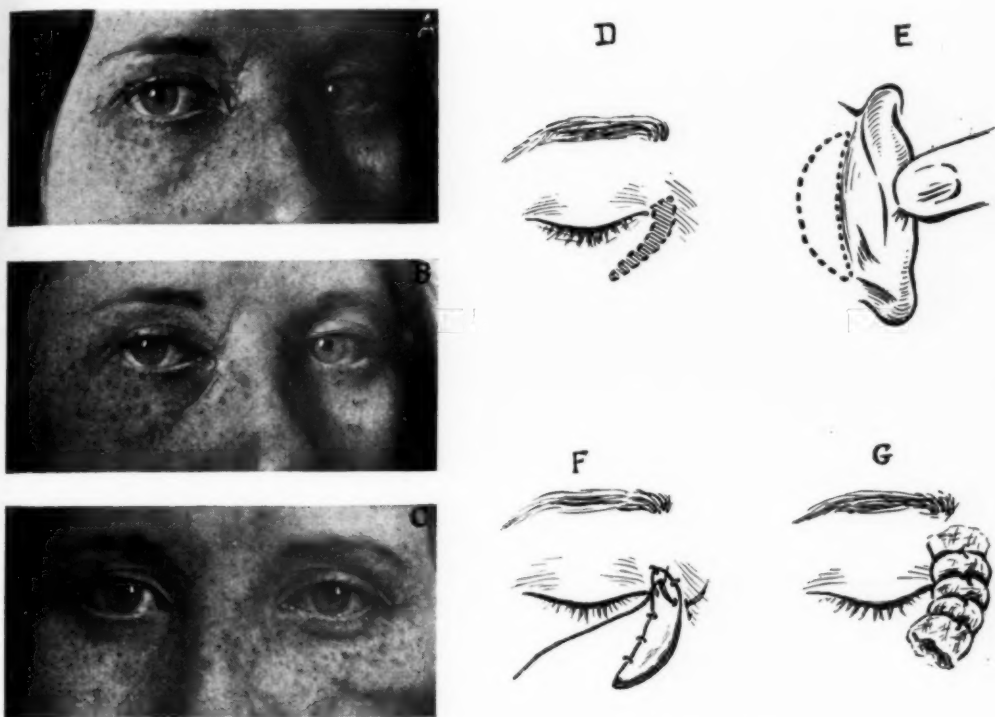


FIG. 12. DISTORTION DUE TO CICATRICIAL CONTRACTURE

Injured in an auto accident eight weeks previously. Dr. Stevens of DuQuoin, Illinois, reported that there was a fracture of the skull, a transverse fracture of the face, and several cuts about the face. *A* shows the condition when she was referred for removal of facial scars.

There were tattoo marks from road oil in several places with also a heavy keloid scar which drew the skin of the lid inward and forward onto the bridge of the nose. She had a subacute sinus infection which was treated by Dr. Arthur Proetz while she was under our care.

Besides removing the various tattooed scars, the scar in the side of the nose was excised and an attempt was made to fill the defect by undermining and drawing on the tissues covering the bridge. This latter proved unsatisfactory, and healing caused further distortion of the canthus (see *B*, taken two months later). The scar was again excised, all distorted tissues released, and a full thickness skin graft from behind the ear was sutured in place (see *D*, *E*, *F*, and *G*).

The result shown in *C* is satisfactory to her in every way except for the slight lateral displacement of the nose which we refused to attack for fear of not bettering the situation. There is a slight plica from the outer border of the graft to the upper lid which we suggested correcting, but she was not interested.

## CONTROLLED READING

DAVID W. WELLS, M.D., F.A.C.S.  
BOSTON

A device for holding a bar between the eyes and the page to be read, in such position that each eye must be used at least part of the time for every line read is recommended as a means of forcing binocular use of eyes in cases showing a tendency to suppress the image of one eye. Best results are to be obtained where the device is used for practically all close work done by the patient. Other devices having multiple bars are also described.

In my monograph, "The Stereoscope in ophthalmology" (E. F. Mahady Company, 851 Boylston St., Boston, Publishers), there is a chapter devoted to controlled reading. Through correspondence and conversation with many who have adopted this stereoscopic treatment of heterophoria, it transpires that few have utilized this controlled reading idea, thinking it of little importance.

My attention was first called to this subject through reading Javal's "Manuel du strabisme". This book was published in 1896 and came into my hands three years later, and although a most valuable treatise on nonoperative treatment, it has never appeared in English.

In the chapter on controlled reading, Javal illustrated a device of George J. Bull of Paris which resembles a stereoscope without lenses, the middle partition having been removed and a vertical bar substituted. The position of the bar between the face and the reading matter, placed in the clips, requires the use of both eyes to see behind it. These clips are not adapted for holding a book or newspaper, and so the control is an exercise, not a control of all reading.

For book or newspaper controlled reading he shows a grille-like affair, consisting of five bars with inter-spaces five times the width of the bars. This is mounted on four legs which rest upon the book or paper. While this leaves both hands free, it necessitates laying the book flat on the table and looking straight down on it. Obviously this is not a natural nor easy pose. I have used the grille as a hand device (Fig. 1). This multiple control is much harder to dodge, especially with a narrow newspaper column, but it leaves only one hand free for holding the paper. In order to control all near use of the eyes, in

sewing, reading, or writing, both hands must be free. To accomplish this purpose, twenty-five years ago, I devised a control consisting of a band of blackened aluminum 12 mm. wide, held between the face and the reading, not by the hand, but by a head band. Patients



Fig. 1 (Wells). The grille held between the face and the reading matter forces reader to employ both eyes either together or alternately.

who tend to suppress the image in one eye, when looking at the stereoscopic charts, are made to use this constantly for months (Fig. 2).

In order to secure multiple control a band terminating in three bars is occasionally used (Fig. 3). This is a more effective control, but requires a precision of adjustment of distance, which is somewhat annoying in ordinary reading, and makes it more of an *exercice*.



Stereoscopic exercises are useful *while the exercise is being done*, but the control device says to the patient at least once in every line, "Use both



Fig. 2 (Wells). A head band holds the bar between the face and the page to be read.

eyes". Psychology teaches that the cultivation of a habit depends upon the frequency of the doing.

It is cheerfully acknowledged that controlled reading is not necessarily stereoscopic vision; rapid alternation will secure the same result, but it is a very important factor in training fusion. Even though stereoscopic vision be well developed, and only the slightest tendency to suppression be detected, this absolute control is very much appreciated.

A man who is considered honest may have at times a lurking tendency to go wrong. If he be surrounded by safeguards such as cash registers, double entry bookkeeping, and the like, he may be kept straight, and if these precautions be continued long enough, the habit of honesty may become so thoroughly automatic that he no longer needs the control. It is possible, however, that such a person, realizing his innate delinquency, might prefer to con-

tinue these safeguards. So it happens that many patients continue controlled reading long after it seems to me to have served its purpose.

When controlled reading is advised, the fact that the patient is suppressing one eye with the stereoscopic charts is demonstrated to him, and he is shown how the control makes it impossible to read a whole line with either eye separately. He is told that he will be annoyed at first, but that as soon as he learns to use both eyes, his annoyance will turn to comfort, with a definite relief of symptoms. Moreover, he is warned not to read without it, except when in a conspicuous place where it would necessitate too much explanation. Out of thousands of cases, I believe not more than two or three percent have balked at the proposition.

The almost universal relief volunteered by the users and the immense

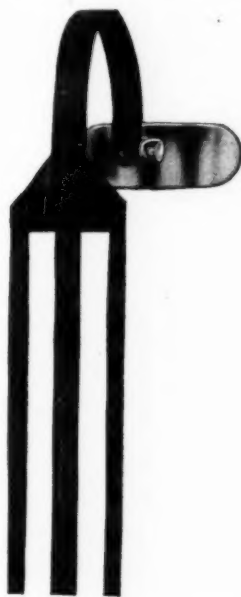


Fig. 3 (Wells). Triple control device.

satisfaction to myself force me to ask any skeptic to give controlled reading a trial.

The apparatus is to be obtained of Pinkham and Smith Company, Boylston Street, Boston, or at any branch of the American Optical Company.

## RATIONAL EMPLOYMENT OF EYE-DROPS AND EYE-OINTMENTS

EMIL OLÁH, M.D.  
GYULA, HUNGARY

The author deduces from careful observation and experiment that drops and ointments instilled into the lower sulcus are carried into the upper sulcus in very dilute form if at all. From the Ophthalmic Department of the Royal Hungarian State Hospital at Gyula, Hungary, of which the author is chief physician.

Noting that all parts of the eye are not equally numb when cocaine solution is dropped into the lower fornix, I suspected that drops so instilled did not get under the upper eyelid, and made different tests to determine where the drop goes when placed in the lower fornix. After instilling cocaine, I inserted a two millimeter slip of white filter-paper into the upper and lower fornices. Then a suspension of China-ink, was placed in the lower fornix.

Before winking began, it could be observed how the tears thinned the China-ink and certain particles rose above the edge of the lower eyelid. The bulk of the particles traveled toward the inner canthus, while a smaller part spread over the lower part of the conjunctiva and the cornea, and part ran along the lid margin into the outer corner.

At the first wink the edge of the upper eyelid pushed the ink downward and directed it from the outer corner towards the inner, where a part of it trickled into the canaliculi, dyeing the puncta. Most of it, however, was carried out onto the cheek. In a few minutes, all of the China-ink was gone, except for a little in the angles formed by the edges of the lids and the eyeball. The filter-paper under the upper eyelid was unstained, but that in the lower fornix was dyed pitch-black. The same result was obtained when cocaine was not used previously.

Experiments with a one percent aqueous solution of eosin gave similar results. All of the conjunctiva was dyed red except that of the upper eyelid, the upper fornix, and that part of the bulbar conjunctiva that is behind the upper eyelid, which remained in certain cases quite undyed, while in others

it was dyed lightly in spots. The white filter-paper placed in the upper fornix, was unstained when the upper part of the eyeball was not dyed, and was dyed quite rarely even in those cases when the upper surface showed spots of dye. Then it was colored a faint violet corresponding to immersion in a 1 to 10,000 solution, while the paper placed in the lower fornix showed a red hue, corresponding to that from a solution of one percent. The drop put into the lower fornix was distributed as shown in figure 1. The upper limit of the dyed



Fig. 1 (Oláh). The shaded line shows the spread of drops placed in the lower sulcus.

surface was always the lower edge of the upper eyelid.

The drops put into the lower fornix with the patient erect reached the upper fornix only exceptionally, even then much diluted, a one percent solution becoming as thin as 1 to 10,000. In most cases nothing reached there.

In order to find out if the edge of

the lower eyelid behaved the same as the edge of the upper eyelid I dipped a white filter-paper (2 sq. mm.) into eosin, and placed it in the pit of the lower fornix. In a few minutes the parts of the conjunctiva were dyed red, just as when a large drop was put into the lower fornix. From this I deduce that the fraction of a single drop is as effective as several drops; concentration is the important factor. It is proper to employ smaller drops as the excess goes at once to the tear-well, and thence to the cheek. If, after the instilling, the patient presses the eyelids together tightly, the edge of the upper lid tips slightly and some of the drop may get behind it. If the eosin be dispensed with the patient supine, the filter-paper placed in the pit of the upper fornix will be found dyed.

These experiments confirmed my opinion that with the head erect it is unusual for the drops instilled into the lower fornix to reach the upper. Drops to act upon the entire surface of the conjunctiva, must be dispensed into the upper fornix. For example, the right way to anesthetize the eyeball is to instil the drops under the upper lid.

The eosin instilled under the upper lid first dyes the whole conjunctival sac, then trickles down the cornea. It likewise dyes the filter-papers placed in both the upper and the lower fornices. This instillation is performed most simply by pulling the outer third of the upper eyelid slightly upward and outward, while the patient gazes downward.

Some tests were made to determine whether mydriatics behaved differently when instilled into the lower fornix than when placed under the upper lid. The action of scopolamine was so strong that no difference could be ascertained as to the beginning of the dilatation. Later one-fourth of one percent homatropine was placed in the lower sulcus of one eye and under the upper lid of the other. In the majority of these cases the pupil expanded a little sooner where the instillation was above; in some cases dilatation was simultaneous on the two sides but it

was quite exceptional that the eye instilled below dilated sooner.

Sander's (*Klin. M. f. Augenh.*, 1931, v. 86, p. 829) results do not agree. He writes: "Die alte Methode ist sinngemäss und richtig, wenn man auf die Bindehaut wirken will." By the old method he means instillation into the lower fornix, by pulling the lower lid down while the patient looks up. For the other method, he lifts the upper lid while the patient holds the head back and directs the eye downward, the drop being placed at the upper edge of the cornea. If one proceeds as directed in many textbooks (as Grosz-Hoor: *Manual of Ophthalmology*), by causing the patient to look downward after the drop is placed in the lower sulcus so the cornea is bathed in the solution, one finds little difference between instillation above and below.

The explanation as to why a solution instilled into the lower fornix does not reach the upper fornix, except when a patient is lying, while a solution instilled under the upper eyelid permeates every part of the conjunctival sac lies in the structure of the eyelids and in their unequal and peculiar function corresponding to their design. The drops instilled into the lower fornix will move from the place of instillation only by capillarity. If the eyelids are lifted from the eyeball by a speculum, the drops placed in the lower fornix will not travel any farther. The solution can only move along if the anterior and posterior sides of the conjunctival sac are in contact where the drop happens to be. When we pull the lower eyelid down, only the medial portion is lowered, while the lateral parts lie on the eyeball. Thus, by the rule of capillarity, diffusion is strongest laterally and the drop at once proceeds towards the outer canthus. When the lid is released, then in the lower sac only that much remains of the drop as will wet it; the rest is forced above the edge of the lid, covering its margin, the bottom part of the cornea, and the exposed bulbar conjunctiva. Now the drop travels from the outer corner in that angle formed by the edge of the

upper lid and the globe. Thus there is a moment before the first winking when the solution in the fissure spreads from the outer canthus to the puncta, covering the bottom part of the cornea, but not its middle and upper parts. If winking takes place before the solution has attained the angle of the upper eyelid, the edge of the latter drives the fluid towards the inner corner, where it overflows the smooth skin-covered border of the tear-well.



Fig. 2 (Oláh). The outer third of the upper lid is lifted to receive the ointment.

In these tests I ascertained that the solutions got under the edge of the upper eyelid only in exceptional cases. In explaining this, we have to take advantage of suppositions as well as positive facts. The upper eyelid forms a right angle at the back, the sharpness being insured by the stiff edges. The angle at the edge of the lower lid is not so acute. Thus the back edge of the upper eyelid adheres closely to the eyeball and possibly in closing, the edge is pressed against the globe even more tightly. My tests tend to show that in the diffusion on the free surface of the eye only the play of the eyelids has a rôle, the power of capillarity none. The influence of capillarity extends only to the parts above the edge of the upper lid and below the edge of the lower lid.

It is the play of the upper lid that keeps the free surface of the eye wet by strewing moisture upon it.

This thin film drying on the cornea would be a hindrance to clear sight. Therefore every wink must wipe the fluid off, and to do this, the lid must press so tightly upon the ball as to prevent the drop from getting through.

In the second period of the wink, when the eye is still, from the solution in the angle at the edge of the upper lid, a minimal quantity can rise beneath the lid-margin by capillarity. The drops getting into the upper fornix, are so thinned (a one percent solution being diluted to about 1:10,000) that practically no drops pass from the lower fornix into the upper.

From the lower fornix the drops have a free path out and nasally, partly because of the rounded lid margin, and partly because its function does not necessitate its pressing so tightly to the eyeball. When the patient is lying the drops pass into the tear-well and remain there. The bordering skin folds do not adhere tightly to the globe, and capillarity can carry the drop into every part of the sac.

Ointments must likewise be dispensed under the upper lid, if the drug is to act upon the surface of the conjunctiva. If mydriatics or miotics be used in the form of ointments, they should also be dispensed in the same way, for a remedy applied as an oint-

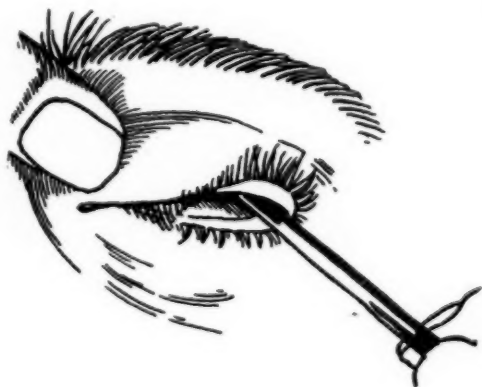


Fig. 3 (Oláh). The edge of the lid is drawn inward to retain the ointment as the rod is withdrawn.



ment is diffused in the moisture of the conjunctiva before being absorbed. This is also true when the ointment is to lubricate the conjunctiva.

The method of applying the ointment is illustrated in figures 2 and 3. The ointment covered tip of the glass-rod is inserted under the elevated outer third of the upper lid which is then drawn inward retaining the ointment as the rod is withdrawn.

It is well known that the catarrh caused by the diplobacillus of Morax-Axenfeld is apparently quickly cured,

but often recurs within a short time. We might believe that the drops dispensed into the lower fornix can not affect the part of the conjunctiva above the edge of the upper lid. By the use of drops and ointments, the infection of the conjunctiva in the fissure and corners of the eye lessens. The subjective complaints cease and seemingly the trouble is cured. The diplobacillus may remain unaffected in the region above and the whole conjunctiva thus be re-infected.

*Allami Korhazi Foorvos.*

## REFRACTIVE ASYMMETRY IN THE TEMPORAL AND NASAL HALVES OF THE VISUAL FIELD

C. E. FERREE, PH.D., G. RAND, PH.D., AND C. HARDY  
BALTIMORE

This paper is a further study of the refraction in the peripheral field of vision. Objective methods by means of a Zeiss refractionometer were employed. Three types of eyes in regard to peripheral refraction were noted. Type A, in which the eye becomes more myopic in the horizontal plane toward the periphery and more hyperopic in the vertical plane, and type B, in which myopia decreases in the horizontal plane, and hyperopia increases in the vertical plane as the periphery is approached have been discussed in a previous article. The present report concerns type C, in which a considerable difference was found between the nasal and temporal halves of the field. From the Research Laboratory of Physiological Optics, Wilmer Ophthalmological Institute, Johns Hopkins Medical School.

### Introduction

Several important reasons may be given for studying the refractive condition in the peripheral field of vision. Among them may be mentioned: (1) the obvious relation of these conditions to acuity in the peripheral field; (2) their relation to achromatic and chromatic sensitivity in peripheral vision and to the limits of the form and color fields; (3) their relation to the peculiarities and anomalies of peripheral space perception and to the space illusions; (4) their possible relation to defects of imagery in the central field and to ocular deviations; and (5) the information which they give as to the positioning of the lens and the symmetry of conformation of the retina.

With reference to the above needs or any needs of practical application, the attempts that have been previously made to refract the eye for the peripheral field are unsatisfactory for the

following reasons: (1) the methods used were either unsatisfactory as to accuracy or so cumbersome as to apparatus and procedure as to be worthless for practical work. (2) The results were not expressed in a form that has practical meaning or value. And (3) the determinations extended but a short distance into the peripheral field. A very important part of our purpose in making the study reported in this and a previous paper<sup>1</sup> has been, therefore, the development of a method that will permit of determinations in the more remote parts of the field, that will be reasonably satisfactory as to accuracy and feasibility, and that will give results directly in terms of diopter values.

The two most important factors in the ametropia for the peripheral field are (1) the effect of the oblique incidence of the rays of light from objects in the peripheral field on the clear-

ness of the image formed; and (2) the effect of size and shape of the eyeball and of anomalies and irregularities in the conformation of the retina on the distance of the percipient elements from the nodal point of the refracting system. With reference to the first of these factors it will be remembered that clear images are formed by lenses only when the object to be imaged is located on the principal axis of the lens. When the object is displaced from the principal axis a distortion of the image occurs which varies in amount with the angle of displacement of the object or with the angle of incidence of the light on the lens. In general, the effect of varying the angle of incidence is that of adding a weak plus sphere and a strong plus cylinder with its axis at right angles to the plane of incidence. The major effect is thus to create a strong astigmatism. A simple formula for this effect in the two meridians may be expressed as follows:<sup>2</sup>

$$F_1 = \frac{F(\mu - 1)}{\mu \cos b - \cos a}$$

$$F_2 = F_1 \cos^2 a$$

In these formulas  $F$  represents the focal length of the lens in question;  $F_1$  the focal length in the meridian of least refractive power;  $F_2$ , the focal length in the meridian of greatest refractive power;  $a$ , the angle of incidence of the light;  $b$ , the angle of refraction at the first surface; and  $\mu$ , the refractive index of the lens. In both meridians, then, the image is brought nearer to the lens as the angle of incidence increases, very much nearer in the meridian of the oblique incidence and very little nearer in the meridian at right angles to it. The refractive effect for the eye would thus be a slight myopia compounded with a strong myopic astigmatism. The effect on vision is modified, however, by the fact that the distance of the retina from the nodal point of the refracting system decreases rapidly as the distance from the fovea is increased. In the greater number of eyes the effect of this is to bring the retina between the foci in the two

meridians or to cause a mixed astigmatism which increases in diopter value as the periphery of the retina is approached. As was shown in the former paper and as will be shown later in this paper, however, other types of eyes are also found, but they do not seem to be of such frequent occurrence.

### Method and Apparatus

For the refraction of the eye for the peripheral field a Zeiss parallax refractionometer modified to suit our purpose was used. Like all the objective methods of refraction, the method used with this instrument provides a means of locating the point or plane which is the anterior of the pair of conjugate foci of the refracting system of the eye. Of this pair the fundus is the posterior focus. Also like the other objective methods, refraction with the ophthalmoscope and with the retinoscope, the method is only approximately correct in principle, that is, the fundus and not the percipient elements is taken as the posterior focus. The reflecting surfaces which make up the fundus cannot be assumed to have the same location as the percipient elements nor even to sustain an invariable relation to them in the different parts of the eye ground and in different eyes. The distance between these reflecting surfaces and the percipient elements is minute, it is true, but in a refracting system as powerful as that of the eye even minute changes of distance in the posterior focus may become of consequence in the location of the anterior focus. The subjective methods of refraction alone start with the true posterior focus of the refracting system. This is one of the reasons why they should be the final court of appeal in making an accurate refraction.

The subjective method, however, we find, can be used with but indifferent success in the peripheral field. Of the objective methods that used with the parallax refractionometer has thus far been found by us to be the most satisfactory for this work.

In brief, the principle of locating the posterior of the conjugate foci of the

refracting system of the eye utilized in the Zeiss refractionometer is as follows. At the principal focus of the objective lens of the instrument is placed a trans-illuminated test object. The rays of light from this test object are collimated by the lens and enter the pupil of the eye as a parallel beam. If the eye is emmetropic the image will be focussed on the fundus (approximately). Likewise when the eye is emmetropic the light reflected from the fundus will emerge from the pupil of the eye as a parallel beam and will be focused by the objective lens of the instrument at the position of the test object. In order to be able to compare the distances of the test object and of the image so formed from the objective lens of the instrument, the principle of parallax is used; that is, the line of view of the examiner is displaced slightly to one side of the principal axis of the refracting system of the eye and objective lens. If the distances of object and image from the objective lens are equal, the image will superimpose on the test object and will not be visible (emmetropia). If it is nearer to the lens than the test object the image will be seen displaced to one side of the test object, the side towards the illuminating tube of the instrument (myopia); if it is further from the lens than the test-object it will be seen displaced to the other side, the side opposite the illuminating tube of the instrument (hyperopia). In order to provide for the refraction of the eye in different planes in the examination for astigmatism, the system can be rotated through  $180^\circ$  and the determinations made at any position within this range. In case the position of the test object and of its image are found not to coincide, the test object is moved until exact coincidence is obtained. The vertex refraction can then be read from a scale which is seen just above the test object. For a more detailed description of the instrument the reader is referred to the circular issued by the manufacturer.

As the instrument is placed on the market, it is designed only for refraction at the center of the field. As modified by us, it can be used at any point

in the horizontal meridian from the center of the field to an eccentricity of  $60^\circ$  temporally or nasally. Beyond this point the image reflected from the fundus is too dim to be distinguished. The instrument as modified for our purpose is shown in figure 1.

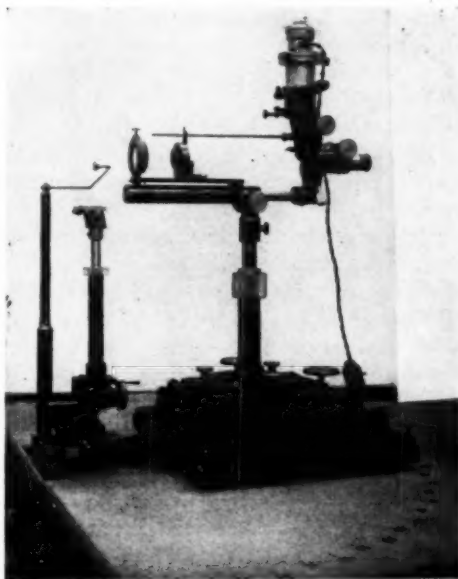


Fig. 1 (Ferree, Rand, and Hardy). Modified Zeiss parallax refractionometer.

As seen in figure 1 the instrument is mounted on a carriage provided with ball and socket casters and made to pivot about a fixed point. The circle described by the carriage is graduated in degrees. The position of the carriage is read by means of a pointer which is located at the back of the carriage in the vertical plane passing through the principal axis of the optical system of the instrument. This pointer passes over the graduated scale. In order that the eye may be located with precision vertically above the fixed point and thus be at the center of rotation of the instrument, a small disc is mounted at the point of intersection of the perpendicular erected at the fixed point with the principal axis of the optical system. When the eye is in position the front of the closed lid is in contact with this disc. To maintain the eye in this position the observer is required

to bite a mouthboard in which the impression of his teeth has previously been made and hardened in wax. The disc is then turned out of the way.

In order to facilitate the location of the eye in the desired position the mouthboard is mounted on a rest provided with up and down, back and forth, and right and left adjustments. The adjustments are made by coarse-threaded screws. The screws for the right and left and the back and forth adjustments are driven by small wheels; the screw for the vertical adjustment is operated by a large milled head.

**Method of controlling fixation and accommodation.** It is supposed to be possible to use the instrument both with and without a cycloplegic. Both of these conditions have been used in this work. The directions given in the descriptive circular referred to above for the refraction of the central field without a cycloplegic are as follows: The patient is directed to look into the instrument with the eye under examination and to fixate the bright clear spot seen in the center of the field. This is for the control of fixation. For the control of accommodation the test target, which becomes clearly visible when it is located at the patient's far point, is always moved from a position beyond the far point towards the far point. The intention of this is to cause the patient to relax his accommodation in the interest of clear seeing.

We have not found this method to be entirely satisfactory. More reproducible results were obtained and results that check better with the subjective methods of refraction, by enlisting the aid of the eye not under examination; that is, by the use of both eyes, better control can be exercised over both fixation and accommodation. The procedure is as follows: When central refraction is to be determined, the eye not under examination is required to look at the smallest detail it can discriminate on a test chart at a distance of 6 meters. If it is hyperopic or emmetropic it is fogged to 0.50 diopter of myopia to induce relaxation of accommodation. If it is myopic, it is already

fogged for distance. In that case a larger detail to be discriminated has to be selected on the test chart. To guarantee that the eye not under examination is taking the same fixation as the eye under examination when it is looking at the bright dot at the center of the test field, as is required in the use of the instrument, the test chart is so located that the bright spot is seen at the center of the detail which serves for the fixation of the eye not under examination. This satisfies the two essential conditions; namely, that the two eyes are fixating in proper coordination and that the eye under examination is fixating the bright dot at the center of the test field. In refracting for the peripheral field, the eye under examination can not, of course, be caused to look into the instrument. In this case both eyes fixate the distant chart whenever possible. This was possible only from  $25^{\circ}$  to  $60^{\circ}$ . That is, for the range 0 to  $25^{\circ}$ , when the temporal field was being refracted, the instrument was interposed between the test chart and the eye under examination. The fixation then had to be maintained by the other eye alone. For the range 0 to  $25^{\circ}$ , when the nasal field was being refracted, the instrument was interposed between both eyes and the test chart. In this case the effect of distance was given to the eye not under examination by mounting close in front of it a small test letter placed at, nearer or beyond the principal focus of a double convex lens, thus causing the rays of light from the lens to enter the eye parallel, diverging or converging as desired. Coordination of fixation for the zero position of the instrument was secured by locating the object and the bright spot in the instrument in such relation that the test objects presented to the two eyes were seen as combined in the median plane. When a cycloplegic was used, the procedure was the same, with the exception that the fixating eye was not fogged.

With the eyes in position and the fixation held as described above, the refraction of the eye was read at the center and in the nasal and temporal quadrants of the horizontal meridian at in-



tervals of  $5^\circ$  or  $10^\circ$  out to  $60^\circ$ . At each angle of incidence tested, the refraction for both the horizontal and the vertical planes was recorded, that is, the refraction in the plane of the incidence of the light and in the plane at right angles to it. The error of reading was approximately 0.25 diopter in the central field and the mid-periphery, and approximately 0.37 to 0.50 diopter in the far periphery where the reflected images, owing to the high degrees of astigmatism present, were indistinct.

### Results

A consideration of the effect of obliqueness of incidence on the refracting powers of a lens would lead one to expect a condition of myopia in the plane corresponding to the plane of incidence in case of an emmetropic eye with its refracting system symmetrically disposed in relation to the line of sight; that is, the effect of the oblique incidence in this plane is that of a strong positive cylinder. What the condition would be in the plane at right angles to the plane of incidence would depend upon two factors: (a) the effect of the obliqueness of incidence upon the focus in this plane, which, as already stated, is equivalent to that of the addition of a weak positive sphere; and (b) the shape of the eyeball. In proportion as the eye is spherical in shape, the retina from center to periphery is brought closer to the nodal point of the refracting system. In an emmetropic eye, therefore, with a symmetrical refracting system, one would expect a condition of hyperopia in this plane beginning at a point comparatively near the center of the field. At some point in the periphery in this type of eye a condition of mixed astigmatism might be expected. A mixed astigmatism might be expected also in case of small refractive errors at center, hyperopic or myopic. In case of a sufficient amount of myopia at the center a condition of compound myopia might be found in the periphery and similarly a condition of compound hyperopia in the periphery where a strong hyperopia is present in the central field. Obviously it is also possible that even

with small central errors of refraction, the shape of the curve of the eyeball from the posterior pole towards the equator may be such as to cause either a compound myopia or a compound hyperopia even when there is only a slight error of refraction at the center. In this connection it should be remembered that in case of such a strong refractive system as is found in the eye, a very small difference in distance of the retina from the nodal point is sufficient to cause several diopters difference of myopia or hyperopia as the case may be.

Twenty-one eyes were examined in all, fifteen without and six with a cycloplegic. The amount of refractive error at the center varied among these eyes from 0.25 diopter of astigmatism to several diopters of effect. In general the effect of oblique incidence was an astigmatism which was variously modified in the eyes examined by the distances of the percipient elements from the nodal point of the refractive system. Classified as to peripheral refraction, three types of eyes were found. In one type (A) the eye becomes more myopic in the horizontal plane as the periphery of the retina is approached, and more hyperopic in the vertical plane. That is, the curve for the horizontal plane tends downward as the periphery is approached and the curve for the vertical plane tends upward. In all the cases but one in which there was a high myopic astigmatism (central refraction), this resulted in a mixed astigmatism in the peripheral field, the interval of Sturm varying over a considerable range of diopters. In a second type (B) the eye becomes less myopic in the horizontal plane as the periphery of the field is approached and more hyperopic in the vertical plane; that is, the trend of the curve for both planes is upward. In the cases studied this resulted in a condition of compound hyperopia in the peripheral field for eyes that were hyperopic, emmetropic or moderately myopic in the central field. If strong myopia is present at the center it is obviously possible that a compound myopia might result over a greater part of the peripheral field. In a third type (C) the

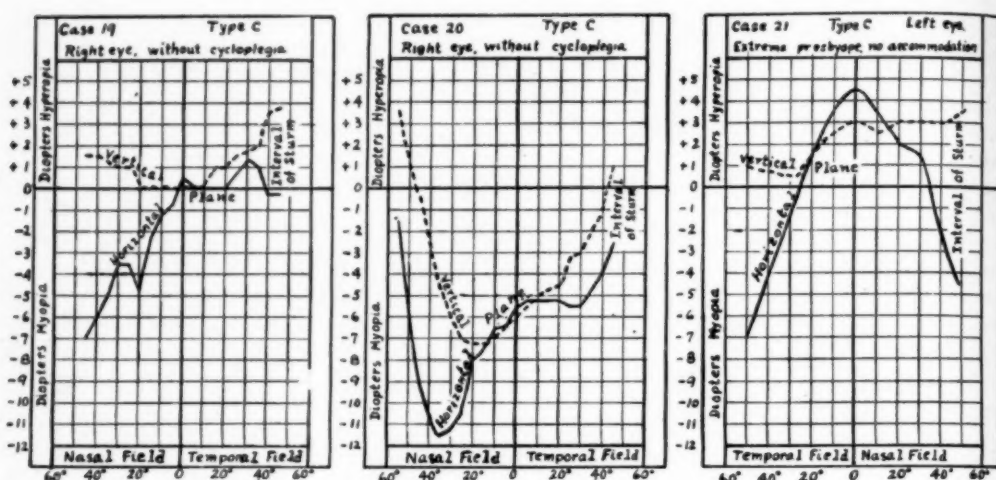


Fig. 2 (Ferree, Rand and Hardy). The refraction of the eye for the peripheral field for three eyes of the class called type C. These eyes show marked asymmetry in the refraction of the nasal and temporal halves of the field.

condition was asymmetrical; that is, a considerable difference was found in the nasal and temporal halves of the field.

Types A and B were discussed in the preceding paper. Type C will be discussed in the present paper. Curves for type C are given in figure 2. For comparison the average curves for types A and B are given in figure 3. In the charts the results for the horizontal plane, the plane of incidence of the

light, are plotted as a solid line; for the vertical plane, the plane at right angles to the plane of incidence of the light, as a broken line. Degrees of eccentricity are plotted along the horizontal coordinate and diopeters of refractive defect along the vertical coordinate. The condition of no refractive defect is represented by a horizontal line drawn through the center of the chart. Diopeters of hyperopia are plotted above this line along the vertical coordinate; diop-

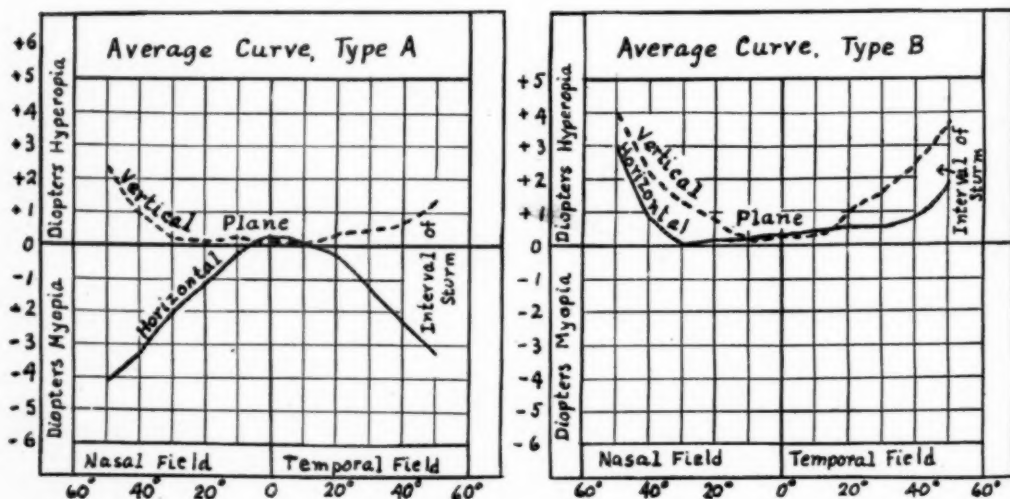


Fig. 3 (Ferree, Rand and Hardy). The chart at the left shows the average refraction of the eye for the peripheral field for six eyes having only a slight error of refraction at the center, type A; that at the right, the average refraction for the peripheral field for five eyes having only a slight error of refraction at the center, type B.

ters of myopia below it. The diopters of hyperopia and myopia are expressed in terms of the correction needed, + and - respectively. The value of the interval of Sturm can be read along the vertical coordinate at corresponding points between the solid and broken lines.

From the statement of principles already given, it is obvious that the shape of the curve drawn as a broken line is determined dominantly by the shape of the eyeball or by the distance of the percipient elements from the nodal point of the refractive system. That is, this curve represents the refraction in the vertical plane at the various points examined and the refraction in this plane is not strongly affected by the angle at which the examination is made. The shape of the curve drawn as a solid line, however, is strongly affected by the angle at which the examination is made. This curve represents the refraction in the horizontal plane, the plane of oblique incidence; and the effect is, as already stated, to bring the focus progressively nearer to the nodal point of the refracting system as the angle at which the examination is made is increased. The former curve thus informs us, roughly at least, as to the symmetry of conformation of the retina; and the latter, together with its relation to the former, gives us information as to the symmetry of action of the refracting system.

Cases which show a pronounced difference in refractive condition in the two halves of the field suggest (a) that the lens may not be symmetrically positioned with reference to the anteroposterior plane of the eye; (b) that there may be asymmetry in the shape of the nasal and temporal halves of the eyeball in the meridian examined or a difference in the distance of the percipient elements from the nodal point of the refracting system in the two halves of this meridian from any cause whatsoever; or (c) that there is a combination of these two conditions. In the three cases shown in figure 2 a pronounced asymmetry was found in the refractive condition of the temporal and nasal halves of the field and in one of these,

case 21, the asymmetry may sustain a causal relation to the ocular deviation which was found to be present. In the other two cases the character of the asymmetry is not such as to lead one to suspect any considerable effect on the muscle balance of the two eyes.

An inspection of case 19 of this chart shows little asymmetry for refraction in the vertical plane; that is, the two halves of the curve for this plane (the broken line) show little difference in shape. At an eccentricity of 40 degrees there are, for example, only about 2 diopters more of hyperopia for the temporal than for the nasal half of the field. From the center to almost 20 degrees in the nasal half of the field the condition is emmetropic; at 30 degrees there is 1 diopter of hyperopia and at 45 degrees 1.5 diopters. In the temporal half of the field there is 1 diopter of hyperopia at 20 degrees, 1.75 diopters at 30 degrees and 3.75 diopters at 45 degrees. For the refraction in the horizontal plane there is, however, a great deal of asymmetry. At the center of the field there is about 0.5 diopter of hyperopia; at 30 degrees in the nasal field there are 3.5 diopters of myopia as against 1.25 diopters of hyperopia in the temporal field; and at 45 degrees in the nasal field, 7 diopters of myopia as against about 0.25 diopter of myopia in the temporal field. Largely because of the asymmetry in refraction in the horizontal plane there is also a pronounced asymmetry in the interval of Sturm in the two halves of the field. Under test this case shows practically no muscle imbalance.

An inspection of the chart shows no reason for expecting a muscle imbalance, so far as the refractive situation, central and peripheral, is concerned. That is, the eye is nearly emmetropic at the center of the field and no deviation in either direction could be expected to improve the refractive condition. The curves for this eye would seem to indicate a fairly symmetrical eyeball in the meridian under examination but an asymmetrical refracting system. The general shape of the curve for the refraction in the horizontal plane is such as might be expected for

a lens rotated or tilted towards the temple. That is, the focus for objects in the nasal field is shorter than for objects in the temporal field as would be the case if the angle of incidence of light on the lens from objects in the nasal field was greater than from objects in the temporal field.

Case 20 of figure 2 shows a pronounced asymmetry of the nasal and temporal halves of the field but it appears to be an asymmetry due to a very considerable extent to the elongation of the eyeball in high myopia. An inspection of the curve representing the refraction in the vertical plane, the curve the shape of which is dominantly



Fig. 4 (Ferree, Rand and Hardy). Cross section of a myopic eye having an axial length of 28 mm. (Taken from Fuch's textbook on Ophthalmology, Philadelphia, J. B. Lippincott Company.)

influenced by the shape of the eyeball, shows the maximum of myopia at about 15 degrees to the nasal side of the center of the field or at a point on the retina about 15 degrees to the temporal side of the fovea. The diopter value of the myopia here is about 7.25; at the center of the field it is 6. From the point of maximum value the curve rises more sharply towards the nasal than towards the temporal side of the field. However, at corresponding points in the two fields the myopia is greater in the nasal than in the temporal field. At 30 degrees it is 6 diopters in the nasal field and 3 diopters in the temporal field; at 40 degrees it is 3 diopters in the nasal field and 1 diopter in the temporal field; at

45 degrees there is 0.5 diopter of myopia in the nasal field and 1 diopter of hyperopia in the temporal field; at 55 degrees there are 3.5 diopters of hyperopia in the nasal field. Measurements were not taken at this point in the temporal field. It is interesting to compare the shape of these curves with the shape of the eyeball in high myopia as is shown by the cross section of the eyeball given in figure 4. In the horizontal plane the value of the myopia at the center of the field was 5.5 diopters; at 35 degrees it reached a maximum in the nasal field of 11.5 diopters; at 45 degrees in the nasal field it was 9 diopters and at 55 degrees, 1.5 diopters. In the temporal field the value of the myopia at 30 degrees was 5.5 diopters and at 45 degrees, 2.5 diopters. A comparison of the shape of the two curves and of the interval of Sturm in the temporal and nasal fields indicates an asymmetry in the refracting system as well as in the shape of the eyeball, such as might be produced by a rotation or tilting of the lens towards the temple. The test both with the Maddox rod and with prisms showed 10 prism diopters of exophoria. When fixation was taken with the right eye alone, a deviation of 20 degrees towards the temple was shown. Measurements of the cornea showed no asymmetry and the value of the curvature in both meridians fell within the normal range. The color fields for red and blue, 1 degree stimuli, showed a contraction in the upper half. The field for 1 degree green was very small. The ocular deviation in this case was probably due to the high degree of myopia. Refractive asymmetry probably had little or nothing to do with it. This may be inferred from the fact that when the myopia for the center of the field was corrected, the deviation practically disappeared and by the fact that a deviation of the eye either temporalward or nasalward could not have been expected to render any very effective service in clearing up the defective imagery.

An inspection of case 21, figure 2, left eye, shows asymmetry in the curves for both the vertical and horizontal planes.



At the center of the field there was a high compound hyperopic astigmatism, 3 diopters in the vertical and 4.5 in the horizontal plane. In the nasal field in the vertical plane there was little change in the hyperopia as far from the center as 50 degrees. In the temporal field it had decreased to 0.5 diopter at 25 degrees and was 1 diopter at 50 degrees. In the nasal field in the horizontal plane it decreased to zero at 35 degrees; and at 50 degrees there were 4.5 diopters of myopia. In the temporal field the hyperopia decreased to zero at 25 degrees; and at 50 degrees there were 7 diopters of myopia, just twice the amount as at the corresponding point in the nasal field. It is significant to note that the nearest approach to emmetropia in the eye came at 25 degrees from the center in the nasal field. The defect here was 0.5 diopter of simple hyperopic astigmatism (against the rule).

The vision in this eye was 20/200 and could not be improved substantially by correction. The patient stated that prior to 15 years ago there was, so far as he knew, no vision at all in this eye. An examination for central scotoma gave negative results. That is, while the test object was seen vaguely at the center it was seen equally clearly there and in the field surrounding the center for 15 degrees to 20 degrees in all directions. A test with the Haitz charts showed that when both eyes were open the vision in this eye was entirely suppressed. When the right eye was closed, however, the figure for the left eye in the chart was seen. When both eyes were open there was no observable deviation in either eye; but when the right eye was closed the left immediately turned inwards and took a fixation approximately 25 degrees from the median plane. It will be remembered from figure 2 that the nearest approach to emmetropia in the left eye was at an eccentricity of 25 degrees in the temporal field. When using this eye alone, the patient apparently turned the eye inwards about 25 degrees in order that objects in front should be in the line of the least refractive error and the clearest image be formed on the retina.

In the course of the examination of the eye the blind spot was mapped on the tangent screen of the Ferree-Rand perimeter with a 0.5 degree white stimulus on a black background. With the eye turned towards the center of the arc of the perimeter, the fixation object could not be seen with sufficient clearness to give a satisfactory control of fixation. In order to secure a correct fixation, the left eye was lined up by means of the telescope inserted in the hollow axle of the perimeter. (When both eyes were open the axes of the two eyes were approximately parallel.) The right eye was then closed whereupon the left took its usual converging position. A large fixation cross (3 cm. diameter) was moved along the horizontal meridian temporalwards to the point at which it could be seen most clearly. The highest visibility was attained at a point approximately 25 degrees from the center of the arc. This it will be remembered, was the point in the field at which there was the smallest error of refraction, 0.5 diopter simple hyperopic astigmatism. With the fixation object at this point a fairly satisfactory control of fixation was secured and a map of the blind spot was made. The location of the fixation object and the map of the blind spot are shown in figure 5. In mapping the blind spot a somewhat lower reproducibility of result was had than is ordinarily obtained. This shows that the control of fixation was, perhaps, not entirely satisfactory.

In conclusion the following points may be noted.

(1) The possible bearing of asymmetrical refraction in the peripheral field on the explanation of cases in which central vision can not be substantially improved by correction in eyes which show no central scotoma.

(2) The rôle which asymmetrical refraction may play in cases of ocular deviation and the bearing that the demonstration of such a condition may have on the treatment of the case.

(3) The possibility of determining roughly the conformation of the retina and the shape of the posterior half of the eyeball by refracting the eye for the

peripheral field; also of determining within rather wide limits in cases of

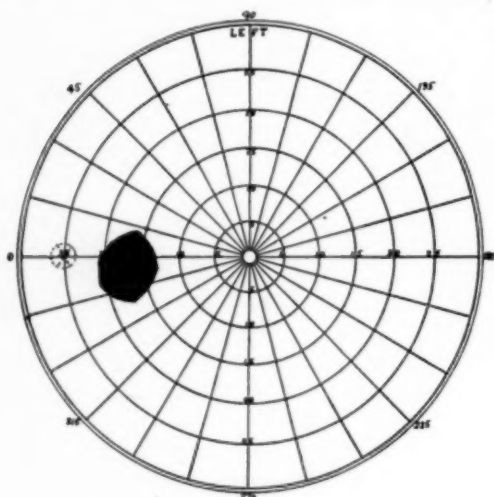


Fig. 5 (Ferree, Rand and Hardy). Showing the blind spot and the location of the fixation point for case 21.

refractive asymmetry whether the defect is in the refracting system or in the conformation of the retina or in both.

(4) The possibility and comparative practicability of using the Zeiss refractionometer modified as described in this paper for studying the refractive conditions in the peripheral field and in testing for refractive asymmetry. To give this instrument maximum service for this purpose, however, a further modification should be devised to make the examination possible and feasible for the upper and lower as well as for the nasal and temporal halves of the field. Cases which might be tested to advantage in this way as clinic procedure are those in which a pronounced ocular deviation is combined with low central vision and no detectable central scotoma.

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# A SINGLE SCLERO-MUSCULAR SUTURE IN JAMESON'S RECESSION FOR SQUINT

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A single double armed catgut suture is used to attach the muscle to the sclera at the point to which it is to be recessed.

For the past two years, in performing the muscle recession for the correction of strabismus, I have been using one double armed catgut suture in order to anchor the muscle in the new scleral position, instead of using three interrupted sutures as first published by Jameson<sup>1</sup>. I proceed as follows: After the incision of the conjunctiva is completed, the muscle is grasped with a forceps near the sclera, the tendon is severed from its insertion and the belly of the muscle is freed from scleral adhesions if present. On the freely exposed sclera a point is marked which is to be as many millimeters back from the original insertion of the muscle as the muscle is to be recessed (Fig. 1, no. 3), and on a line which starts at the middle of said scleral insertion and follows the horizontal meridian of the globe (Fig. 1, a-b). This point marks the place whereabout the central and lateral insertions of the suture must be placed and the muscle must be sutured.

The needle of the upper end of the suture (Fig. 1, no. 9) inserted in the sclera at about 1 mm. directly below the chosen point will run under the su-

perficial fibers of this structure in oblique direction forward and upward coming out at about 1 mm. above the said a-b meridian (Fig. 1, nos. 1-2).

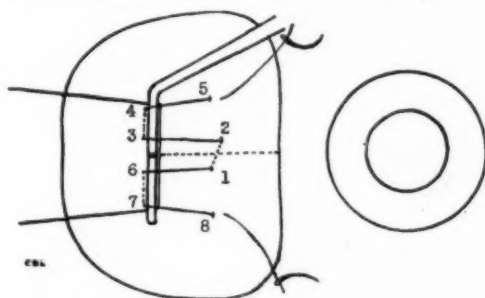


Fig. 2 (Lombardo). Nos. 1 and 2 show the position of the central part of the suture; no. 5 the upper lateral; and no. 8 the lower lateral.

The same needle is now passed through the muscle from its conjunctival side 2 mm. above its central horizontal line and close to the clamp. The Reese's forceps has a groove on the center of the blade, which, if properly placed, indicates the center of the muscle.

The needle is then passed through the muscle from its scleral side, very near its upper margin (Fig. 2, no. 4), and then again under the superficial fibers of the sclera, the point of entrance being at about 6 mm. vertically above the chosen scleral point (Fig. 2, no. 5).

The same procedure is followed in the lower half of the muscle with the lower end of the suture which will be passed in the sclera at about 6 mm. vertically below the chosen point (Fig. 2, no. 8).

The forceps is now removed and a gentle traction made on the upper and lower end of the suture in order to stretch the cut margin of the muscle on the sclera while it is approximated to the new position. The two needles are then passed under the conjunctiva and

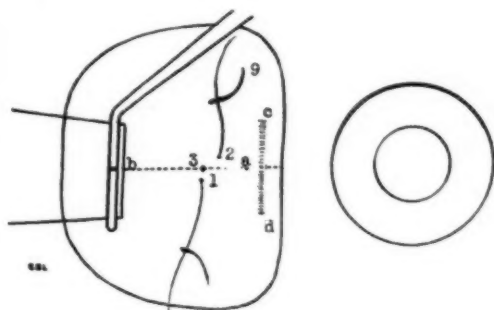


Fig. 1 (Lombardo). c-d original insertion of the muscle, no. 3 shows the distance from the original insertion that the muscle is to be recessed on the horizontal meridian a-b. No. 1 shows the point of entrance in the sclera of the needle no. 9; no. 2 its point of exit.

perforating it near the cornea about two millimeters apart are tied on its external side (Fig. 3).

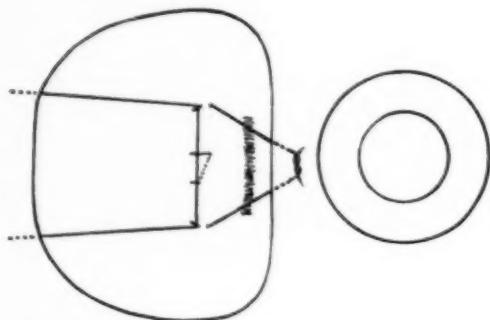


Fig. 3 (Lombardo). Shows the cut margin of the muscle in its new scleral position.

Additional sutures of silk are used to get a complete closure of the lips of the conjunctival wound (Fig. 4).

The advantage in the use of one suture is that the procedure is more simple and rapid. When traction is exerted

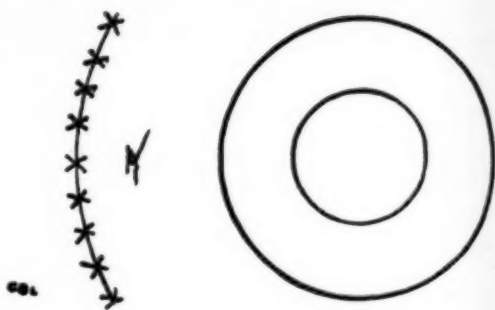


Fig. 4 (Lombardo). Conjunctival closure with interrupted silk. Catgut tied outside the conjunctiva.

on the two ends of the suture, the cut margin of the muscle, while being approximated to the new position, is broadly spread on the sclera with a resulting large scleral attachment. No gap is formed as all the margin of the muscle comes in juxtaposition with the sclera where the union has to take place.

142 Joralemon street.

#### Reference

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## A CORNEO-SCLERAL DERMOID IN A GUINEA PIG

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A dermoid which was found on the eye of a guinea pig was studied histologically. Several similar tumors on the eyes of other mammals have been reported in the literature. From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital, Baltimore.

As stated by Fuchs<sup>1</sup>, "Dermoid tumors should not be confounded with dermoid cysts, of which, in fact, they are the direct opposite (Salzmann). In dermoid cysts the cutis is outside, the epidermis inside; in the dermoid tumor the layers have their normal arrangement, the epidermis being outside and the cutis with the subcutaneous fat lying within". Dermoids are not commonly found in man; nor are they frequently seen among the lower animals. The cystic type is somewhat more prevalent.

I wish to put on record a case of a corneoscleral dermoid seen in a guinea pig.

In the right eye of an ordinary-sized, brown guinea pig there was discovered an ovoid growth 2 x 4 mm. in diameter, situated on the cornea, touching the limbus at the upper margin. Two dilated vessels with several minute branches could be traced from the upper portion of the sclera running to the tumor. The growth appeared brownish gray in color and was slightly elevated. Three fine, short, brown hairs protruded from its uneven surface. It was sharply demarcated from the adjacent, transparent cornea. Bordering its lower edge were two whitish plaques, each 1 mm. in diameter. The other findings in the right eye were negative. No abnormalities existed in the left eye.

The animal was killed by etherization. The right eye was enucleated and preserved in Bouin solution. After several days, sagittal sections were made. They were stained with hematoxylin and eosin.

Under the microscope, the tumor assumed a more or less semicircular form. Continuous with the corneal epithelium was the investing epithelium of the tumor, which was one and a half times as thick as the former. The latter was com-

posed of stratified epithelial cells, the basal layer being darkly pigmented. Inside of this covering was a narrow zone of loose connective tissue where some blood vessels were located. The remainder of the growth which constituted the major portion, contained numerous hair follicles with sebaceous glands. The entire tumor rested on the substantia propria of the cornea and did not invade it at any point.

The literature does not contain very many cases of dermoid tumors of the cornea in animals. References to their presence in certain mammals will be noted here. However, it is not my intention to give a complete review of all the published articles.

Oeller<sup>2</sup> reported a case in a pig. Dobson<sup>3</sup> saw one in a dog. Garson<sup>4</sup> called our attention to specimen 373 in the Catalogue of the Teratological Series in the museum of the Royal College of Surgeons of England. This shows a corneoscleral dermoid in the eye of a sheep. Schmidt-Rimpler<sup>5</sup> described one in the eye of a calf, with dislocation of the lens. Salfner<sup>6</sup> found dermoids in both eyes of a newborn horse.

Wardrop<sup>7</sup> published an interesting case of congenital dermoid in a man fifty years of age. Twelve long hairs grew from the center of the tumor, passed between the eyelids, and hung over the cheek. These hairs did not appear until the sixteenth year, at which time the beard began to grow. Among the recent papers on dermoids of the cornea in man are those written by Castello<sup>8</sup>, Dunnington<sup>9</sup>, and Horner and Cordis<sup>10</sup>. Other references have been noted by Henke and Lubarsch<sup>11</sup>.

According to Parsons<sup>12</sup>, dermoids were described as early as 1742. The designation, "dermoids", was first used by Ryba<sup>13</sup> in 1853. Various theories have been advanced as to the origin of



Fig. 1 (Chan). Section of dermoid tumor of the cornea of a guinea pig (x 31).

these growths. Ryba believed that the failure of complete closure of the eyelids would result in cornification of the conjunctiva. To support his theory, he cited the correspondence of dermoid and lidnotch. Collins, who concurred with him, mentioned the fact that cryptophthalmia was an exaggerated manifestation of the dermoid. No palpebral defect was observed in my case. Remak and others considered that solid dermoids, like the cystic form, originated from a fetal invagination of the external germ layer. Van Duyse ascribed them to amniotic adhesions which might happen before the fourth month of intra-uterine life, that is, when the eyeball was still uncovered by the lids. Gallenga stated that remnants of the plica semilunaris, which in fetal life covers the globe like its phylogenetic equivalent the nictitating membrane, might produce dermoids.

The writer wants to express his many thanks to Mrs. E. L. Burky for preparing the specimen. He is also greatly indebted to Dr. Jonas S. Friedenwald, who has given him much help and advice.

*Wilmer Ophthalmological Institute.*

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## STUDIES IN OCULAR FATIGUE

### IV. Fatigue of accommodation, experimental and clinical observations

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AND

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A study of two groups of records made in the testing of fatigue of accommodation with ergographs 5 and 6 is presented. The first group of 165 qualified and 14 disqualified aviators were tested under lowered oxygen tension. More rapid recession of the accommodation nearpoint was found than under normal oxygen tension. The second group of 195 records of accommodation fatigue of office patients, mostly asthenopic, showed variation in type of record. Accommodation fatigue is not easily produced. A high positive correlation was noted between objective and subjective evidence of accommodation fatigue. Duane's standard nearpoint of accommodation for age was not found to be a reliable criterion of ability to accommodate without rapid fatigue. Many typical records are presented in detail. Read before the International Congress of Ophthalmology, Amsterdam and The Hague, September 5-13, 1929, and published in part in the Transactions of the Congress. From the Department of Physiology, Columbia University.

The studies reported in this paper are based on investigations of fatigue of accommodation begun in 1918, using Howe's original ophthalmic ergograph and his methods. With Howe's<sup>1</sup> pioneer work as a basis, several instruments and new methods have been devised to overcome difficulties which made it impossible to obtain comparable records. The apparatus and methods formerly employed, the evolution of the present instrument, and the methods now used have been described elsewhere<sup>2</sup>.

Study of the effect of simulated altitude on accommodation preceded the clinical investigation of fatigue of accommodation, therefore this phase of the subject will first be briefly outlined.

#### The effect of altitude and low oxygen tension on accommodation

The increasing importance of aviation makes a clear understanding of the effect of low oxygen tension on accommodation an important practical problem. The weakening effect of altitude on accommodation was noted by balloonists in the early history of ballooning, for several men recorded the fact that they were unable to see the mercury column in the barometer at high altitudes although their vision for distant objects was apparently undisturbed, but no scientific investigation of this problem was undertaken until 1918.

#### The nearpoint of accommodation as affected by altitude, simulated by lowering oxygen tension

Two groups of men were examined<sup>3</sup>. The A group were men qualified as aviation pilots in the Air Service of the Army of the United States by passing the rigid physical examination and rebreathing tests. The second, or B group was composed of men disqualified as pilots by these tests. After control tests of the nearpoint of accommodation

had been taken every two minutes, the effect of simulated altitude by means of low oxygen tension was determined with the Henderson-Pierce rebreathing apparatus and in the Pierce low pressure chamber. In the A group 165 men, and in the B group 14 men, were examined. The reactions produced in the low pressure chamber and in the rebreathing apparatus were practically identical. Approximately 45 percent of the A group showed decrease in the power of accommodation in both methods of testing. In the B group 64 percent responded by recession of the nearpoint in the rebreathing test, and the three men examined in the low pressure chamber exhibited failure of accommodation. From these studies it is believed that aviators who have less than 2 diopters of hypermetropia and less than 0.50 diopter of hypermetropic astigmatism and whose nearpoint of accommodation is normal for Duane's table for all ages, will seldom, if ever, have a serious disturbance of accommodation before they show marked circulatory or psychological disturbances due to oxygen want.

After 600 aviators were examined it was considered unnecessary to make tests of low oxygen tension effect, provided the accommodation, vision, muscle balance, and muscle strength were normal and there was less than 2 diopters of hypermetropia and 0.50 diopter of hypermetropic astigmatism.

Fatigue of accommodation as affected by low oxygen tension was also studied with Howe's ophthalmic ergograph and the first three modifications of his instrument. Three minute tests with three minute intervals were made without the low oxygen tension effect; then three minute runs with the same time intervals were made in the low pressure chamber and with the rebreathing apparatus. The findings with the rebreathing apparatus and with the low pressure chamber showed, at 15,000 feet, a more rapid onset of fatigue than was evidenced by con-

trols, and at 20,000 feet fatigue as evidenced by recession of the near point was marked. This effect is well illustrated in figure 1.

#### Fatigue of accommodation in practice

Although the ophthalmic ergograph has proved valuable in studying the effect of altitude and low oxygen tension on accommodation—and this work, owing to the development of aviation is of growing importance—its greatest interest for the clinician lies in the value it may have in studying and treating patients complaining of asthenopic symptoms.

It is probable that too much emphasis was placed by early writers on the local and general diseases and symptoms produced by

a factor in the situation. A ten or fifteen minute time limit has been found satisfactory, and in this series of cases, unless constant blurring of the test object occurred before the time limit set, the tests were continued for ten or fifteen minutes. Seventeen records, however, were continued for more than fifteen minutes ranging from sixteen to 57 minutes. The time limit of two records was six minutes.

These records have been divided into three classes; those in which the amplitude of excursion increases, those in which it remains practically constant, and those in which it decreases. Increase in amplitude of excursion means an advancement of the punctum proximum and is considered an im-

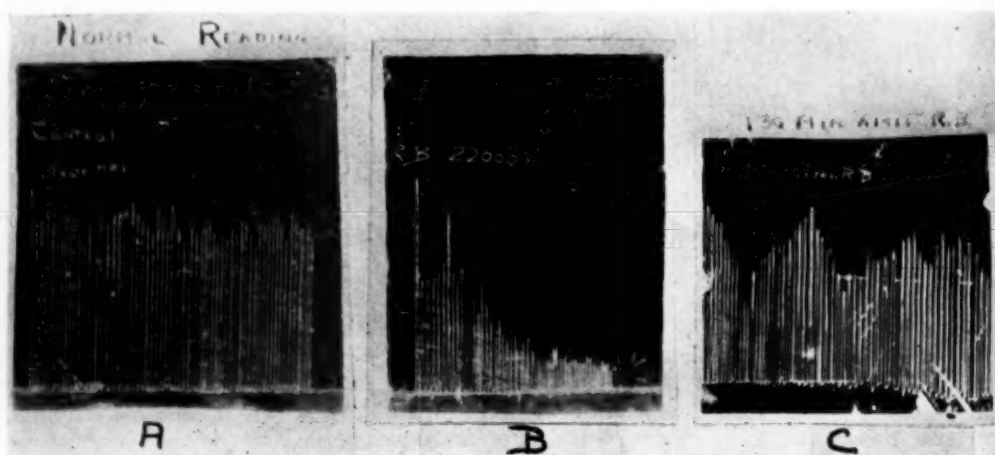


Fig. 1. Effect of altitude, simulated by a rebreathing test, on fatigue of accommodation. Record A, control test without low oxygen tension effect. Record B, rapid fatigue and recession of the nearpoint of accommodation at 22,000 feet. Record C, control record 90 minutes after rebreathing test, no fatigue in three minute run.

"eye strain", and Howe<sup>4</sup> stated that only three groups could be safely included, namely, symptoms referred to the eyes, head, and stomach. It is hoped that the work recorded here may again emphasize the importance of studying asthenopia and possibly point out a practical method of analyzing certain cases.

When the preparation of this paper was begun, there were 195 clinical records of accommodation fatigue in our files. The majority of these records were made with the sixth accommodation ergograph. With the exception of nine records, the test object used was a card on which were printed letters of 50 cm. type. Of the nine exceptions, five were made with 75 cm. type and one with 2 meter type as the subjects could not discriminate finer type. The Duane line was used as a test object for the remaining three. Illumination was not standardized but was never less than five foot-candles.

When ergograph records are continued for more than fifteen minutes, the subjects become restless and general fatigue becomes

provement while decrease in amplitude indicates a recession of the nearpoint and is considered as loss of ability to accommodate, probably due to fatigue of accommodation. Records of normal eyes\* illustrating each

\* Normal eyes have been considered as those in which the vision was at least 6/6 or 20/20, there was not more than one diopter of manifest hyperopia or myopia, and one-half diopter of astigmatism, nearpoint of accommodation within normal limits set by Duane<sup>5</sup>, no ocular pathology, and muscle balance and vergence within the following limits derived from a study of 223 normal men<sup>6</sup>: Near point of convergence from the cornea, maximum 80 mm. Muscle balance, maximum variation allowed at 6 meters, esophoria 2.5<sup>Δ</sup> and exophoria 2<sup>Δ</sup>; at 25 centimeters, esophoria 2.5<sup>Δ</sup> and exophoria 6<sup>Δ</sup>. Muscle strength minimum vergence allowed at 6 meters, prism convergence 12<sup>Δ</sup>, prism divergence 5<sup>Δ</sup>; at 25 centimeters, prism convergence 32<sup>Δ</sup>, and prism divergence 12<sup>Δ</sup>.





Fig. 2. Patient 3620, Miss E. W., aged 15 years, complaining of headaches. Vision 6/6 in each eye. Accepts under cycloplegic, O.D.—0.25 D. sph.—0.50 cyl. axis 120°. O.S.—0.50 cyl. axis 60°. Wearing, O.D.—0.25 D. sph.—0.50 cyl. axis 125°; O.S.—0.12 D. sph.—0.50 cyl. axis 60°. Vision in each eye with correction 6/6. Nearpoint of accommodation 80 mm. O.U. Nearpoint of convergence 50 mm. At 6 meters: esophoria  $\frac{1}{2}\Delta$ , prism divergence 8 $\Delta$ , prism convergence 25 $\Delta$ . At 25 centimeters; esophoria 2 $\frac{1}{2}\Delta$ , prism divergence 15 $\Delta$ , prism convergence 50 $\Delta$ .

Ergograph record 309, 1/3/27. Accommodation fatigue test, both eyes, with correction, 20 mm. amplitude of excursion, ten minutes, time limit. Good cooperation. Record shows marked improvement rather than fatigue. After test, muscle balance, esophoria  $\frac{1}{2}\Delta$  at 6 meters, esophoria 5 $\Delta$  at 25 centimeters.

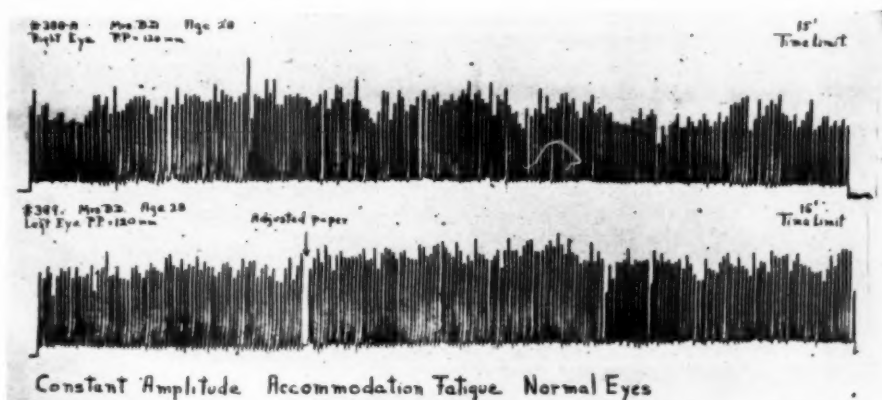


Fig. 3. Patient 7312, Mrs. B. D., aged 28 years. Chief complaints, photophobia, eye strain after reading one-half hour and after moving pictures. Patient pregnant at time of examination. Vision without correction 6/6 in each eye. Accepts under cycloplegic O.D.—0.25 D. sph.+0.50 cyl. axis 100°, O.S.—0.25 D. sph.+0.25 cyl. axis 80°. Given same correction. Nearpoint of accommodation 100 mm. in each eye. Nearpoint of convergence 50 mm. At 6 meters: orthophoria, prism divergence 7 $\Delta$ , prism convergence 20 $\Delta$ . At 25 centimeters; orthophoria, prism divergence 15 $\Delta$ , prism convergence 45 $\Delta$ .

Ergograph records 388A. and 389, 12/18/27. Accommodation fatigue test right eye and left eye, respectively, with correction. 20 mm. excursion. Both records fifteen minutes, time limit, no evidence of fatigue. Excellent cooperation and reliability. Orthophoria for distance and near after tests.

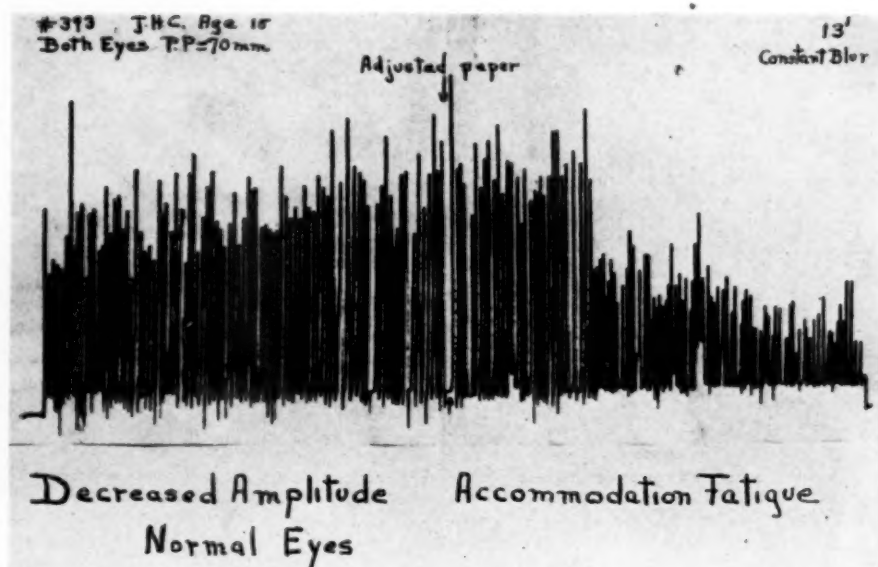


Fig. 4. Patient 6340, J. H. C., 3rd, aged 15 years. Chief complaint, blurring on reading. History of sinus trouble during past year. Vision without correction 6/4 in each eye. Accepts under cycloplegic, O.D.+0.25 cyl. axis 85°, O.S.+0.25 cyl. axis 90°. No lens given. Combined nearpoint of accommodation 70 mm. Nearpoint of convergence 40 mm. At 6 meters: esophoria 2Δ, prism divergence 5Δ, prism convergence 20Δ. At 25 centimeters: exophoria 4Δ, prism divergence 15Δ, prism convergence 50Δ.

Ergograph record 393, 12/23/27. Accommodation fatigue test both eyes. 20 mm. excursion. Constant blurring of test object in 13 minutes. Fair cooperation and reliability. Tilted head back and kept poor time with signal bell. Muscle balance after the test, esophoria 3Δ at 6 meters, orthophoria at 25 centimeters.

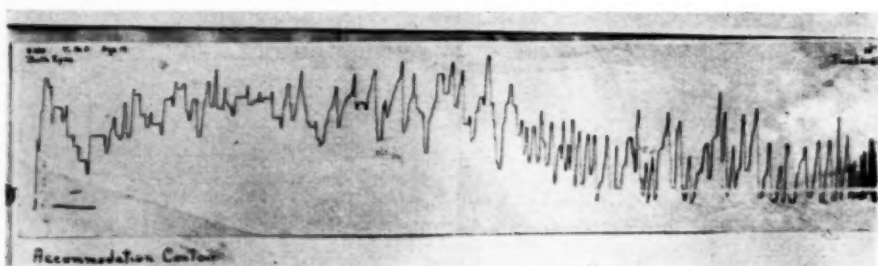


Fig. 5. Accommodation contour. Patient 6047, Miss V. McG., aged 13 years. Complaining of lacrimation and eyes tiring on close work. Vision 6/6 in each eye. Accepts under cycloplegic O.D.+1.25 D. sph.+0.25 cyl. axis 90°; O.S.+1.25 D. sph. Given O.D.+0.75 D. sph.+0.25 cyl. axis 90°, O.S.+0.75 D. sph.; vision 6/4 in each eye. Nearpoint of accommodation with correction 110 mm. in each eye. Nearpoint of convergence 50 mm. At 6 meters: orthophoria, prism divergence 5Δ, prism convergence 25Δ. At 25 centimeters: esophoria 1Δ, prism divergence 15Δ, prism convergence 50Δ.

Ergograph record 180, 4/10/26. Accommodation fatigue test (contour) both eyes, without correction. Fifteen minutes time limit. Good cooperation. Record shows recession of the nearpoint. Muscle balance after the test, exophoria 1/2Δ at 6 meters, exophoria 1Δ at 25 centimeters.

Table I

SUMMARY OF 195 RECORDS OF ACCOMMODATION FATIGUE MADE WITH THE OPHTHALMIC ERGOGRAPH

	Increased Amplitude	Constant Amplitude	Decreased Amplitude	Total
No. in each group.....	56	79	60	195
No. completing time limit 10 to 15 min...	46	49	17	112
No. stopped because of constant blur....	6	20	38	64 <sup>1</sup>
P.P. normal for age (Duane standard)....	40	52	34	126
P.P. subnormal for age (Duane standard)...	12	22	19	53 <sup>2</sup>
No. with normal P.P. completing time limit	36	37	14	87
No. with normal P.P. and constant blur..	4	8	16	28
No. with subnormal P.P. completing time limit.....	10	10	3	23
No. with subnormal P.P. and constant blur	1	10	15	26

<sup>1</sup> Stopped for other reasons or reason for stopping not given—19 records.<sup>2</sup> Data incomplete—16 records.

type are shown in figures 2, 3 and 4\*. These are all repeated effort tests. Figure 5 shows an accommodation contour, the graphic record of a sustained effort test.

The data collected in the study of 195 records of fatigue of accommodation are summarized in table 1. Table 1-a gives the results in percentage values.

#### Discussion of results

With 56 (28.7 percent) of the records falling in the increased amplitude group, 79 (40.5 percent) in the constant amplitude group, and 60 (30.8 percent) in the decreased amplitude group (see Fig. 6), it cannot be said that any one type of record is the rule.

Furthermore, from the data it is evident that there is no objective manifestation of accommodation fatigue in 69 percent of the cases although in some of these the test had to be discontinued because of constant blurring of the test object. The difficulty of fatiguing accommodation is also emphasized by the fact that only 32.8 percent of the records were stopped because of constant blurring of the test object, while 57.4 percent completed the time limit.

#### Correlation between objective and subjective evidence of accommodation fatigue

Figure 7 represents graphically the percentage distribution of each group in which

Table Ia

DATA OF TABLE I IN PERCENTAGE VALUES

	Increased Amplitude	Constant Amplitude	Decreased Amplitude
Percent in each group.....	28.7	40.5	30.8
Percent of number completing time limit.....	41.1	43.7	15.2
Percent of number in each group completing time limit.	82.1	62.1	28.3
Percent of number stopped because of constant blur...	9.4	31.2	59.4
Percent of number in each group stopped because of constant blur.....	7.1	25.3	63.3
Percent of number with normal P.P. Duane standard...	31.7	41.3	27.0
Percent of number in each group with normal P.P.....	71.4	65.8	56.7
Percent of number with subnormal P.P.....	22.6	41.5	35.9
Percent of number in each group with subnormal P.P...	21.4	27.8	31.7
Percent of number with normal P.P. completing time limit.....	41.4	42.5	16.1
Percent of each group with normal P.P. completing time limit.....	90.0	71.1	41.1
Percent of number with subnormal P.P. completing time limit.....	43.5	43.5	13.0
Percent of group with subnormal P.P. completing time limit.....	83.3	47.6	15.8
Percent of number with normal P.P. and constant blur..	14.3	28.6	57.1
Percent of each group with normal P.P. and constant blur	10.0	15.4	47.0
Percent of number with subnormal P.P. and constant blur	3.8	38.5	57.7
Percent of each group with subnormal P.P. and constant blur.....	8.0	45.4	79.0

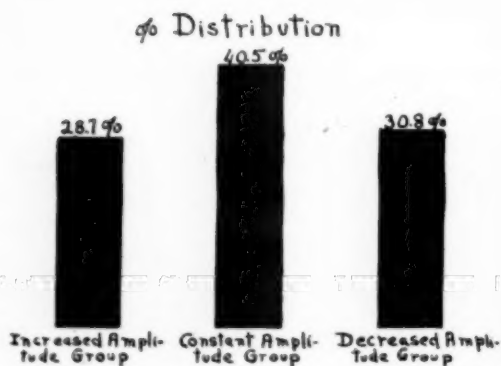


Fig. 6. Graphic representation of the percentage distribution of records in the three groups.

the time limit was completed and also gives a contiguous comparison with the percentage of records which were stopped because of constant blurring of the test object. There is a significant decrease (82.1 percent, 62.1 percent, 28.3 percent) from increased to constant to decreased amplitude group, in the ability to complete a test and a significant rise (7.1 percent, 25.3 percent, 63.3 percent) in the records stopped because of constant blurring of the test object.

As stated before, decrease in amplitude of excursion is considered as objective evidence of accommodation fatigue. Conversely, increased and constant amplitude of excursion are considered as lack of objective evidence of accommodation fatigue. On the subjective side, constant blurring of the test object is a manifestation of fatigue, and the absence of accommodation fatigue is indicated in the ability to complete the time limit

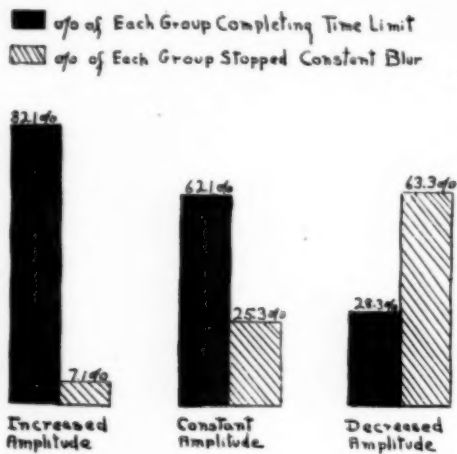


Fig. 7. Graphic representation of the percentage of each group completing the time limit, and a contiguous comparison with the percentage stopped because of constant blurring of the test object.

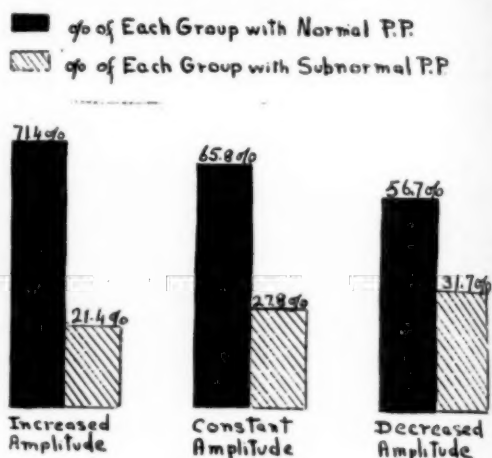


Fig. 8. Graphic representation of the percentage distribution of normal and subnormal nearpoints of accommodation in the three groups.

of an ergograph test. From the following four-fold table, the coefficient of correlation between these characteristics may be determined.

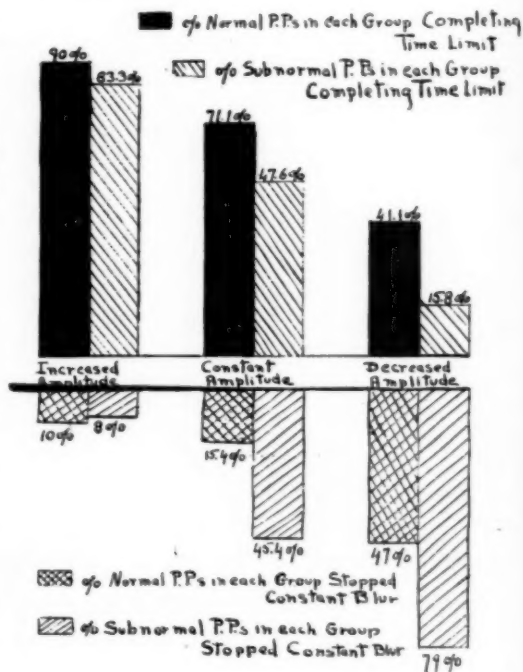


Fig. 9. Graphic representation (above) of the percentage distribution of those with normal and subnormal nearpoints of accommodation in each group completing the time limit, and (below) of those stopped because of constant blurring of the test object.



Table II

RELATION BETWEEN OBJECTIVE AND SUBJECTIVE EVIDENCE OF  
ACCOMMODATION FATIGUE IN ERGOGRAPH TESTS

	No subjective evidence of fatigue (time limit reached)	Subjective evidence of fatigue (stopped constant blur)	Total
No objective evidence of accommodation fatigue (increased and constant groups).....	95(a)	26(b)	121
Objective evidence of accommodation fatigue (decreased group).....	17(c)	38(d)	55
Total.....	112	64	176

Substituting the data of table II in the formula<sup>7, 8</sup>

$$r = \cos \frac{\sqrt{bc}}{\sqrt{ad} + \sqrt{bc}} \pi$$

to determine the coefficient of correlation, we find

$$r = +.69$$

There is then, a high positive correlation between the objective and subjective evidence of accommodation fatigue as we have tested it with the ophthalmic ergograph.

#### Comparison of results with Duane standard

The nearpoint of accommodation was normal according to the Duane standard for age in 126 of the 195 cases. Figure 8 gives the comparative results for both the normal and subnormal nearpoints for each group and shows only a slight drop (approximately 15 percent) in the percentage of normal nearpoints from increased to decreased group, and only a slight rise (approximately 10 percent) in the subnormal nearpoints.

Figure 9 represents graphically the ability of those with normal and subnormal nearpoints of accommodation in each group to complete an ergograph test. Of those with subnormal accommodation in the increased amplitude group 83.3 percent completed the time limit and 47 percent of those with normal accommodation in the decreased amplitude group stopped because of constant blurring of the test object. These results tend to lower the coefficient of correlation between the Duane standard and the ability to complete an ergograph test, determined from the data of table III.

Using the same formula,

$$r = \cos \frac{\sqrt{bc}}{\sqrt{ad} + \sqrt{bc}} \pi$$

to determine the coefficient of correlation between these characteristics, we find

$$r = +.46$$

This correlation between the normal nearpoint of accommodation according to the Duane standard for age and the ability to complete an accommodation fatigue test, though positive, is not high enough to warrant accepting the nearpoint measure in lieu of the more time-consuming fatigue test.

#### Differences in monocular and binocular records

Howe<sup>9</sup> in his second paper on fatigue of accommodation stated that the tracings were frequently quite different for one eye alone from those shown when accommodation is accompanied by convergence. In certain instances, we have found this to be true as illustrated by figure 10 (the records of Mr. T. M., aged 21 years) and figure 11 (the records of Miss F. E. P., aged 30 years). In figure 10, the right eye shows constant blurring with a decrease in the amplitude of excursion at the end of one minute. After a four minute rest the test was tried again, with constant blurring of the test object in forty-three seconds. Results for the left eye are similar, constant blurring of the test object in one minute and twenty-five seconds; after a four minute rest, constant blurring in twenty-three seconds. With both eyes, the fifteen minute time limit was com-

Table III

RELATION BETWEEN DUANE STANDARD AND ABILITY TO COMPLETE ERGOGRAPH TEST

	Time limit reached	Stopped constant blur	Total
Normal near point of accommodation.....	87(a)	28(b)	115
Subnormal near point of accommodation....	23(c)	28(d)	49
Total.....	110	54	164

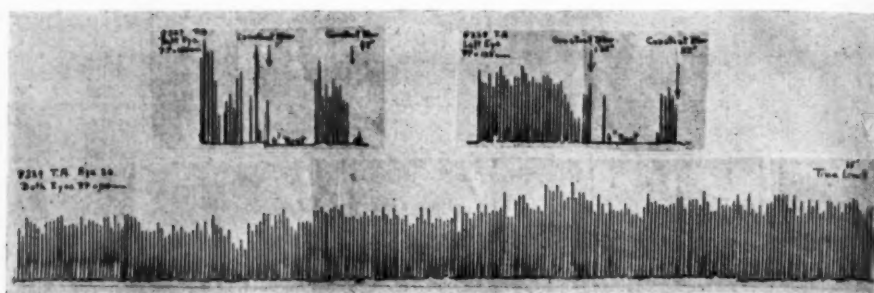


Fig. 10. Showing differences obtained in accommodation fatigue records when eyes are tested separately and together. Patient 5209, Mr. T. M., aged 20 years, college student complaining that he can read only a few minutes when his eyes become very tired, print shimmers and blurs. Vision O.D. 6/9—2, O.S. 6/15+2. Accepts under cycloplegic O.D.—0.75 D. sph.—1.00 cyl. axis 170°; O.S.—1.00 D. sph.—1.00 cyl. axis 45°. Wearing O.D.—0.37 D. sph.—1.00 cyl. axis 180°, O.S.—0.75 D. sph.—0.87 cyl. axis 45°. Vision 6/6 in each eye. No change made in correction. Nearpoint of accommodation with correction O.D. 150 mm., O. S. 125 mm. Nearpoint of convergence 60 mm. At 6 meters: esophoria 1 $\Delta$ , prism divergence 4 $\Delta$ , prism convergence 15 $\Delta$ . At 25 centimeters: exophoria 7 $\Delta$ , prism divergence 15 $\Delta$ , prism convergence 50 $\Delta$ +

Ergograph records 227, 228, and 229. Accommodation fatigue tests right eye, left eye, and both eyes, respectively. Tests made with correction. With right eye, constant blurring of the test object in one minute; after a four minute rest, constant blurring occurred in forty-three seconds. With the left eye, constant blurring in one minute and twenty-five seconds, and again in twenty-three seconds after a four minute rest. With both eyes fifteen minute time limit was completed. Excellent cooperation. Muscle balance after the test, esophoria 4 $\Delta$ , at 6 meters; orthophoria at 25 centimeters.

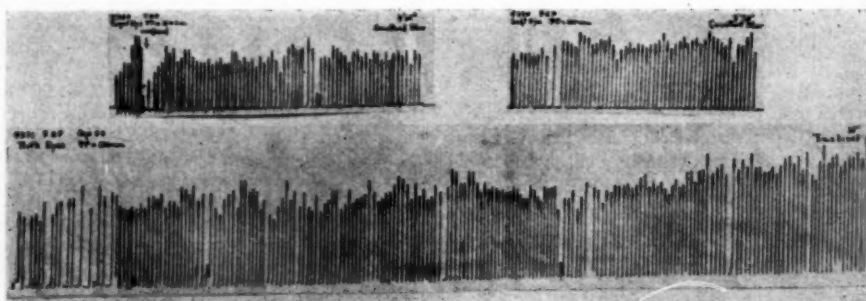


Fig. 11. Showing difference obtained in accommodation fatigue records when eyes are tested separately and together. Patient 3867, Miss F. E. P., aged 30 years. Chief complaints, eyes smart when she reads, headaches. Vision O.D. 6/9, O.S. 6/6. Accepts under cycloplegic O.D.+1.00 D. sph.+0.25 cyl. axis 95°, O.S.+1.00 D. sph.+0.25 cyl. axis 175°. Given same correction; vision 6/6 in each eye. Nearpoint of accommodation with correction O.D. 190 mm., O.S. 116 mm. Nearpoint of convergence 100 mm. At 6 meters: esophoria 1 $\Delta$ , prism divergence 3 $\Delta$ , prism convergence 14 $\Delta$ . At 25 centimeters: esophoria 5 $\Delta$ , prism divergence 20 $\Delta$ , prism convergence 30 $\Delta$ .

Ergograph records 269, 270, 271, 10/20/26. Accommodation fatigue tests right eye, left eye, and both eyes, respectively. Tests made without correction. Nearpoint of accommodation O.D. 150 mm., O.S. 170 mm., O.U. 170 mm., 20 mm. excursion. Constant blurring of the test object with the right eye in four minutes and forty seconds, with the left eye in three minutes and thirty seconds. With both eyes the time limit of fifteen minutes was completed; with this test the patient reported that the test object became clearer the longer she continued. Good cooperation. Muscle balance before the tests: esophoria 1/2 $\Delta$  at 6 meters; exophoria 13 $\Delta$  at 25 centimeters; after the tests esophoria 1 1/2 $\Delta$  at 6 meters, exophoria 8 1/2 $\Delta$  at 25 centimeters.

pleted and the record shows an increase in the amplitude of excursion. Although there is no decrease in the amplitude of excursion for the right or left eye (figure 11) the subject was forced to discontinue the first at the end of four minutes and forty seconds, and the second at the end of three minutes and thirty seconds. With both eyes, however, she completed the fifteen minute time limit with the record showing improvement.

#### Differences in convergence and accommodation fatigue records

The "tracings" may also be quite different for accommodation fatigue than for convergence fatigue, and may afford a means of differentiating the two types of asthenopia.

Figure 12 (records 387 and 388) shows the records for convergence and accommodation fatigue of a patient suffering from chronic sinusitis (frontal and ethmoid) who complained that her eyes tired, that she could not focus them, and that she became wall-eyed. There is a marked decrease in the convergence record with constant diplopia in six minutes, while the accommodation fatigue test continued for fifteen minutes with increasing amplitude of excursion.

Figure 13 (records 464, 465, and 466) shows very rapid convergence fatigue with constant diplopia in two minutes while the accommodation records with each eye show no evidence of fatigue in the ten minute time limit. This patient complained of eye strain, inability to read at night, and headache.

Although the time limit of fifteen minutes was completed in both the convergence and accommodation fatigue records of figure 14 (records 244 and 245), the accommodation record shows a decrease in the amplitude of excursion. Furthermore, the patient felt no fatigue at the end of the convergence test. At the end of the accommodation test, her eyes were tired and globes hurt. She reported that this feeling was similar to the one of which she was complaining.

In spite of a remote nearpoint of convergence of 140 mm. (see record 463, fig. 15) this patient, Mr. W. E. H., showed a marked improvement in his convergence fatigue test during the ten minute run. On the other hand, his accommodation fatigue for the right and left eyes, punctum proximum of accommodation normal in each eye for his age (see records 461 and 462, fig. 15) shows a definite decrease in the amplitude of excursion. This patient complained that his eyes tired and ached, also of headache and photophobia.

#### Two cases of accommodation fatigue

In a previous study<sup>10</sup> it was pointed out that no evidence of convergence fatigue had been found in ten to fifteen minute ergographic records made by subjects whose muscle balance and strength conformed to

the normal standards previously quoted. When these results have been obtained, we feel that convergence fatigue is not a factor and that a convergence ergograph test is not indicated. An instance of this is illustrated by the case of Miss E. B. who returned to us complaining of eyes tiring and aching in the afternoon, and of blurring with persistent use. Vision, nearpoint of accommodation, and muscle measurements made with her correction were all normal. She was wearing +0.25 D. sph.+0.50 cyl. axis 60° in the right eye, and +0.50 cyl. axis 120° in the left eye. The results of accommodation fatigue tests made with the right and left eyes may be seen in figure 16 (records 441 and 442). Correction was not worn and the average of ten readings of the nearpoint taken before the tests was subnormal. Treatment for anemia and glandular deficiency combined with colonic therapy relieved this condition. At the end of three months, the patient had no ocular complaints.

Figures 17 and 18 depict a series of records made by Mr. G. C., who presents a picture of persistent accommodative fatigue only slightly improved by treatment. His chief complaint was inability to read for more than ten minutes at a time. This condition had obtained since an attack of herpes zoster five years prior to his first examination. In addition to a remote nearpoint of accommodation in each eye, examination revealed a remote nearpoint of convergence, weak prism convergence and divergence, and compound hypermetropic astigmatism. He was given the following correction: O.D. +0.50 D. sph.+0.50 cyl. axis 90°, vision 5/6; O.S.+0.87 D. sph.+0.25 cyl. axis 110°, vision 6/6. Ocular treatment included exercises for accommodation, diverging and converging prism exercises, massage and backward pressure on the eyeballs, and the use of an eye lotion. Other treatment consisted of outdoor work, low starch and sugar diet, removal of tonsils, and opening of ethmoids and sphenoids with local treatment of the nose. The neurological diagnosis was encephalitis.

Record 406, figure 17, made at the first examination, shows constant blurring of the test object in one minute and fifty seconds. At the time that record 413 was taken, ten weeks later, this patient reported that he now read fifteen to twenty minutes before blurring occurred. He was forced to discontinue the test in eight minutes and fifty-three seconds. It should be noted, however, that his nearpoint of accommodation was 160 mm. in the first test and 170 mm. in the second. The measurements of the nearpoint of accommodation on his history card show marked variability from time to time.

The records of figure 18 were taken a little more than five months after 413. During the preceding four months, the patient's reading period had increased to one-half hour. The tests were made on the same day

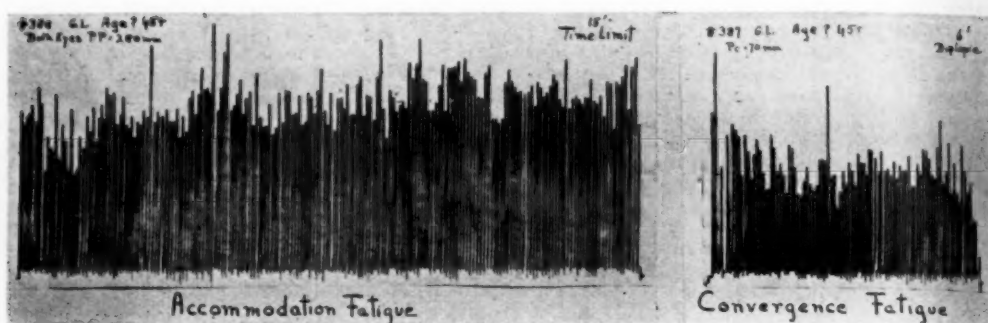


Fig. 12. Comparative differences in convergence and accommodation fatigue records. Patient 7438, Miss G. L., aged 45 years. Chief complaints, cannot focus eyes easily, eyes get tired and wall-eyed; photophobia. Has chronic sinusitis in frontal and ethmoid sinuses. Vision O.D. 6/15, O.S. 6/9+. Accepts under cycloplegic O.D. +4.00 D. sph. +0.25 cyl. axis 10°, O.S. +4.00 D. sph. +0.25 cyl. axis 10°. Wearing O.D. +2.50 D. sph. +0.25 cyl. axis 45°, O.S. +2.50 D. sph. +0.25 cyl. axis 180°. Given O.D. +2.12 D. sph. +0.25 cyl. axis 30°, vision 6/6, O.S. +2.25 D. sph. +0.25 cyl. axis 180°, vision 6/6. Add for reading O.U. +0.50 D. sph. Nearpoint of accommodation both eyes with this correction 255 mm.; with old correction 280 mm. Nearpoint of convergence 70 mm. At 6 meters: exophoria 1 $\Delta$ , prism divergence 8 $\Delta$ , prism convergence 20 $\Delta$ . At 25 centimeters: exophoria 16 $\Delta$ , prism divergence 20 $\Delta$ , prism convergence 20 $\Delta$ .

Ergograph record 387, 12/7/27. Convergence fatigue test without correction. With 20 mm. excursion, diplopia immediately, with 30 mm. excursion constant diplopia in six minutes. Muscle balance after test, exophoria 1 $\Delta$  at 6 meters; exophoria 14 $\Delta$  at 25 centimeters.

Ergograph record 388, 12/7/27, ten minutes after record 387. Accommodation fatigue test, both eyes with old correction. 20 mm. excursion. Record shows improvement rather than fatigue in the fifteen minute time limit. Fair cooperation. Muscle balance after test, exophoria 1 $\Delta$  at 6 meters; exophoria 16 $\Delta$  at 25 centimeters.

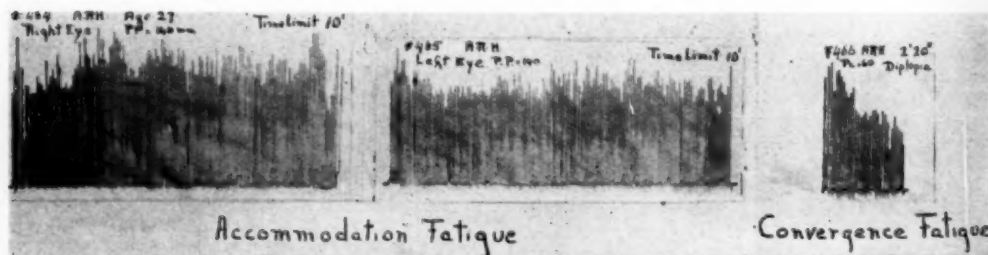


Fig. 13. Comparative differences in convergence and accommodation fatigue records. Normal accommodation, rapid fatigue of convergence. Patient 11142, Miss A. R. H. aged 27 years. Chief complaints: eye strain, inability to read at night, photophobia and headaches. Vision 6/6 in each eye. Accepts under cycloplegic, O.D. +0.37 D. sph. +0.50 cyl. axis 90°, O.S. +0.75 cyl. axis 90°. Given +0.50 cyl. axis 85° in each eye. Nearpoint of accommodation without correction 140 mm. in each eye. Nearpoint of convergence 60 mm. At 6 meters, orthophoria; at 25 centimeters, exophoria 16 $\Delta$ , prism divergence 15 $\Delta$ , prism convergence 40 $\Delta$ .

Ergograph records 464 and 465, 1/22/29. Accommodation fatigue test right eye and left eye, respectively. Both tests without correction. Three minutes rest between records. Excursion 20 mm. Both records ten minutes, time limit. No objective evidence of fatigue. Patient said she felt dizzy at end of record 465. Good cooperation.

Ergograph record 466, 1/22/29. Convergence fatigue test, five minutes after test 465. Constant diplopia in two minutes and twenty seconds. Muscle balance after test: orthophoria at 6 meters, exophoria 15 $\Delta$  at 25 centimeters.



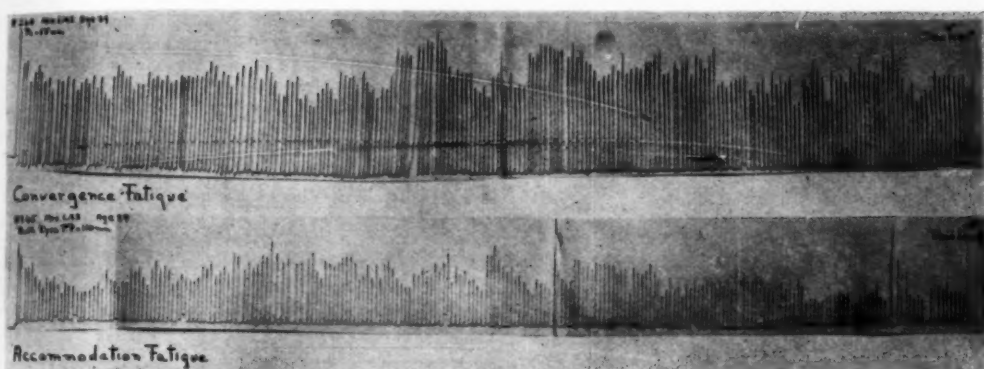


Fig. 14. Comparative differences in convergence and accommodation fatigue records. Patient 6857. Mrs. L. M. S., aged 29 years. Complaining of headaches in eyes, poor distant vision, tiring on reading and slowness in reading. Vision O.D. 6/20. O.S. 6/15-1. Wearing O.D.—1.00 D. sph.—0.50 cyl. axis 180°, vision 6/9; O.S.—0.75 D. sph.—0.50 cyl. axis 135°, vision 6/6-3. Accepts under cycloplegic O.D.—0.75 D. sph.—0.50 cyl. axis 95°, O.S.—.75 D. sph.—0.50 cyl. axis 135°. Given O.D.—0.75 D. sph.—0.50 cyl. axis 95°, O.S.—0.50 D. sph.—0.25 cyl. axis 45°; vision 6/4 in each eye. Combined nearpoint of accommodation without correction 110 mm. Nearpoint of convergence 55 mm. At 6 meters: exophoria  $\frac{1}{2}\Delta$ , prism divergence 8 $\Delta$ , prism convergence 18 $\Delta$ . At 25 centimeters: exophoria 10 $\Delta$ , prism divergence 20 $\Delta$ , prism convergence 20 $\Delta$ .

Ergograph record 244, 10/5/26. Convergence fatigue test. Excursion 25 mm. Fifteen minutes, time limit. No fatigue. Excellent cooperation. Muscle balance after test, esophoria 1 $\Delta$  at 6 meters, exophoria 10 $\Delta$  at 25 centimeters.

Ergograph record 245, 10/5/26. Accommodation fatigue test, both eyes, without correction. Excursion 20 mm. Eyes tired and globes hurt at end of test, feeling similar to that of which patient was complaining. Muscle balance after test, esophoria 1 $\Delta$  at 6 meters, exophoria 8 $\Delta$  at 25 centimeters.

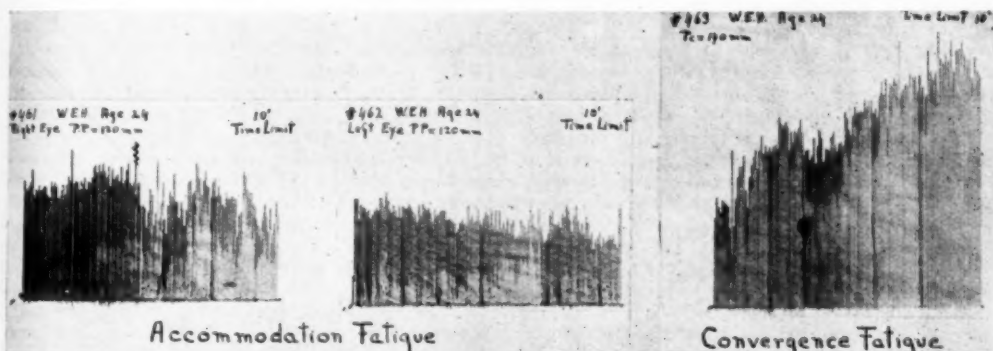


Fig. 15. Comparative differences in convergence and accommodation fatigue records. Patient 11129, Mr. W. E. H., Jr., aged 24 years. Complaining of eyes tiring and aching, headaches and photophobia. Vision O.D. 6/12, O.S. 6/20. Accepts under cycloplegic O.D.—0.50 D. sph.—0.25 cyl. axis 60°, O.S.—0.50 D. sph.—0.25 cyl. axis 120°. Given O.D.—0.25 D. sph.—0.25 cyl. axis 65°, O.S.—0.37 D. sph.—0.25 cyl. axis 120°. Vision 6/4 in each eye. Nearpoint of accommodation 120 mm. in each eye. Nearpoint of convergence 140 mm. At 6 meters: esophoria  $\frac{1}{2}\Delta$ , prism divergence 4 $\Delta$ , prism convergence 10 $\Delta$ . At 25 centimeters: exophoria 14 $\Delta$ , prism divergence 10 $\Delta$ , prism convergence 15 $\Delta$ .

Ergograph records 461 and 462, 1/21/29. Accommodation fatigue test right eye and left eye, respectively, with correction, 20 mm. excursion. Both records 10 minutes, time limit, show decrease in amplitude of excursion. Good cooperation and reliability.

Ergograph record 463, 1/2/29. Convergence fatigue test without correction, 20 mm. excursion. Ten minutes, time limit. Marked increase in amplitude of excursion. Muscle balance after test: esophoria  $\frac{1}{2}\Delta$  at 6 meters; exophoria 20 $\Delta$  at 25 centimeters.

in the order indicated by their numbers, with a six to ten minute rest between tests. The four records show accommodation fatigue. Decrease in amplitude of excursion is less marked in record 427, both eyes, than in 425 and 426 where each eye was tested separately. The accommodation contour, 428, is especially interesting when compared with figure 19 which depicts the results obtained

O.S., 220 mm. O.U. For the experiment proper, both eyes were used for reading and the punctum proximum was tested every three minutes. It began at 220 mm., advanced to 160 mm. at the end of three minutes, and then receded at first slowly and later more rapidly to 310 mm. at the end of thirty minutes. The subject began to complain of blurring at the end of twenty-four minutes

#441 E.B. Age 19 1' 12"  
Right Eye P.P. = 120 mm



#442 E.B. Age 19  
Left Eye P.P. = 115 mm

2' 55"



Fig. 16. A case of accommodative fatigue which responded to general treatment. Patient 2451, Miss E. B., aged 19 years, college student, who returned to us complaining of eyes tiring and aching in afternoon, eyes markedly fatigued after Thursday of each week, and marked blurring with continued use. Vision 6/6 in each eye. Wearing O.D.+0.25 D. sph. +0.50 cyl. axis 60°, O.S.+0.50 cyl. axis 120°. Vision 6/4-1 in each eye. Under cycloplegic eight months before, she had accepted O.D.+0.25 D. sph.+0.50 cyl. axis 45°, O.S.+0.25 D. sph.+0.37 cyl. axis 140°. Nearpoint of accommodation with correction 100 mm. in each eye. Nearpoint of accommodation without correction, average of ten readings before ergograph test, 120 mm. in the right eye, and 115 mm. in the left eye.

The physician to whom she was referred for a general examination reported: "She presents a very interesting gland picture with a slow pulse and low basal metabolic rate, dysthyroid rather than hypothyroid at the time. But when this does occur, I have noticed the eye fatigue symptoms seem out of all proportion to the other symptoms. I thought she presented a pluriglandular picture, mild hypo-ovarian dysthyroid with anemia."

Treatment included thyroid and pituitary gland extracts, potassium iodide (one drop of saturated solution in water five days out of seven), measures for increasing intestinal elimination including colonic irrigations. Ocular treatment included massage and backward pressure of the eyeballs, exercises for accommodation, and prism convergence exercises.

After three months, there was no more fatigue, no more blurred vision, and patient was much improved physically.

Ergograph records 441 and 442, 11/3/28. Accommodation fatigue tests right eye and left eye, respectively, without correction. Constant blurring of the test object, right eye one minute and twelve seconds; left eye, two minutes and fifty-five seconds.

when a test was made on the same subject by the following method used by Lancaster and Williams": "Reading fine print at or near the punctum proximum for various periods up to one hour; punctum proximum and punctum remotum taken before and after; punctum proximum taken at frequent intervals during the test; but punctum remotum not taken during the test, since that would allow the ciliary muscle to relax while it was being tested."

The punctum remotum for near was determined with a +2.50 D. sph. added to his distance correction. Before the test, this was 330 mm. O.D., 300 mm. O.S., and 310 mm. O.U.; after the test 210 mm. O.D., 180 mm.

and of his eyes hurting at the end of twenty-seven minutes.

#### Differential diagnosis of accommodative and retinal fatigue

Several methods may be used to determine whether the fatigue induced by the ergographic method is accommodative or retinal. The simplest one is to recede the test object still farther from the eyes and ascertain whether it becomes clear or remains blurred. In figure 20 (record 274) recession of the test object of 30 mm. enabled the subject to continue the test fifty-five seconds before constant blurring occurred; with a second recession of 40 mm.

the subject was able to continue the test for two minutes and fifty-five seconds.

A stenopeic hole can also be tried after constant blurring occurs. Figure 21 shows two records where this was done and the results which were obtained by continuing the test for two minutes longer in 499 and three and one-half minutes longer in 459. The marked increase in the amplitude of excursion with the use of the pinhole indicates that the fatigue was not retinal. In record 459, made by one of us (C.B.) the efforts were repeated as rapidly as possible. Twice during the test, the eyelids were drawn to make a slit with a resultant increase in the amplitude of excursion, indicated on the record.

Determining whether the addition of plus spheres makes the test object clear is a third possible method of differentiating retinal from accommodative fatigue.

Decrease in amplitude of excursion in itself points to accommodative rather than retinal fatigue, since the test object should appear blurred in any position if the fatigue is retinal. It would seem that the differential check is mainly indicated in those cases where constant blurring occurs with increased or constant amplitude of excursion.

In making deductions from functional tests, so many factors must be considered that the result of any one test or series of tests must be carefully considered in the light of all other subjective and objective evidence; this is particularly true of fatigue of accommodation. Variable factors are now being standardized sufficiently for obtaining comparable scientific data, but careful work must be done for years before final conclusions may be drawn.

The observer must evaluate all psychological factors in each examination.



Fig. 17. A series of records of a patient showing persistent accommodative fatigue only slightly improved by treatment. Patient 7638, Mr. G. C., aged 25 years. Chief complaint, inability to read more than ten minutes at a time. This condition had persisted for five years and followed an attack of herpes zoster. Vision 6/9 in each eye, without correction. Wearing O.D.+0.50 D. sph.+0.25 cyl. axis 90°, O.S.+0.50 D. sph.+0.25 cyl. axis 115°. Accepts under cycloplegic O.D.+0.87 D. sph.+0.50 cyl. axis 90°. O.S.+1.25 D. sph.+0.50 cyl. axis 110°, vision 6/6 in each eye. Given O.D.+0.50 D. sph.+0.50 cyl. axis 90°. O.S.+0.87 D. sph.+0.50 cyl. axis 110°, vision 6/6 in each eye. Nearpoint of accommodation with correction O.D. 150 mm. O.S. 150 mm. O.U. 140 mm. Nearpoint of convergence 110 mm. At 6 meters; esophoria  $\frac{1}{2}\Delta$ , prism divergence  $3\Delta$ , prism convergence  $4\Delta$ . At 25 centimeters: exophoria  $9\Delta$ , prism divergence  $11\Delta$ , prism convergence  $16\Delta$ .

Pupils irregular, right iris fixed to light. Blood and spinal fluid Wassermann tests negative. Neurological diagnosis, encephalitis.

Treatment has included removal of tonsils, opening of ethmoids and sphenoids and local treatment of nose; measures for increasing intestinal elimination, the use of autogenous vaccines, and outdoor work. Ocular treatment has included exercises for accommodation, prism converging and diverging exercises, massage and backward pressure of the eyeballs and the use of an astringent eye lotion.

Ergograph record 406 (Fig. 13), 1/27/28. Accommodation fatigue tests both eyes, with correction. Nearpoint of accommodation 160 mm., 20 mm. excursion. Constant blurring of the test object in one minute and fifty seconds. Cooperation fair, reliability good. Muscle balance after test: esophoria  $\frac{1}{2}\Delta$  at 6 meters, exophoria  $5\Delta$  at 25 centimeters.

Ergograph record 413 (Fig. 13), 4/9/28. Patient reported at this time that he could now read for twenty minutes. Accommodation fatigue test with correction. Nearpoint of accommodation 170 mm., 20 mm. excursion. Constant blurring of the test object in eight minutes and fifty-three seconds. Record shows decrease in amplitude. Muscle balance before the test: esophoria  $1\frac{1}{2}\Delta$  at 6 meters, exophoria  $8\Delta$  at 25 centimeters; after the test esophoria  $\frac{1}{2}\Delta$  and exophoria  $2\frac{1}{2}\Delta$ .

### Summary and conclusions

1. Simulating altitude by lowering oxygen tension in the low pressure chamber or with the rebreathing apparatus produces more rapid recession of the nearpoint of accommodation than is found under normal oxygen tension at sea level. Recession of the nearpoint under low oxygen tension was found in approximately 45 percent of 165

conditions is not considered an essential vocational test for aviators.

2. From a study of 195 consecutive records of accommodation fatigue, made with ophthalmic ergographs 5 and 6, on office patients most of whom were asthenopic, it was found that in the time limit set, ten to fifteen minutes, 28.7 percent showed increase in the amplitude of excursion, in 40.5 per-

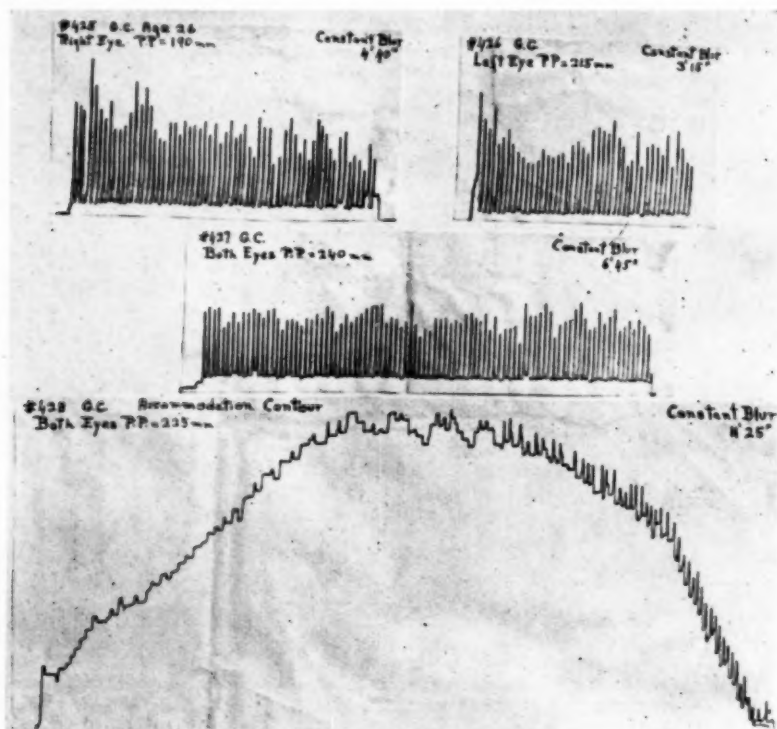


Fig. 18. Ergograph records 425, 426, and 427 (Fig. 14), 9/20/28. Patient now able to read for one-half hour at a time. Records of right eye, left eye, and both eyes, respectively, with correction. Nearpoints of accommodation O.D. 190 mm., O.S. 210 mm. (taken after record 425), O.U. 215 mm. (taken after record 426). Constant blurring of the test object in four minutes and forty seconds with the right eye, three minutes and fifteen seconds with the left eye, and six minutes and forty-five seconds with both eyes. Six minutes rest between 425 and 426, ten minutes rest between 426 and 427. Good cooperation and reliability.

Ergograph record 428, 9/20/28, ten minutes after 427. Accommodation contour, both eyes with correction. Nearpoint of accommodation 225 mm., 20 mm. recession to base. Marked advancement of nearpoint followed by recession to base in eleven minutes and twenty-five seconds.

men physically qualified for the Air Service of the United States Army and in 64 percent of 14 disqualified men. Since subjects who meet the ocular requirements for the Air Service, including nearpoints of accommodation normal according to the Duane standard for age, show a physiologic or psychologic inability to compensate under low oxygen tension before accommodation is markedly affected, determination of the nearpoint of accommodation under these

cent the excursion of the test object remained constant, and in 30.8 percent there was recession of the nearpoint and decrease in the amplitude of excursion. No one type of record, therefore, can be considered the rule. In this, our results do not entirely agree with those of Howe who found rapid decrease in the amplitude of excursion to be usual.

3. We agree with Lancaster and Williams that it is difficult to fatigue accommodation.



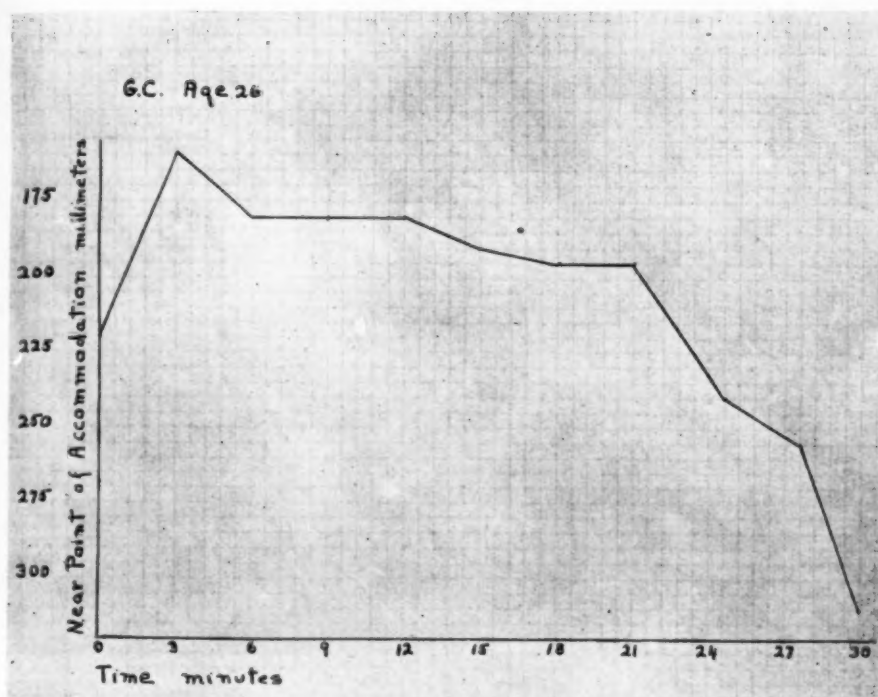


Fig. 19. The nearpoint of accommodation taken every three minutes for one half hour; subject reading fine print held as close to eyes as possible during test period. (Method of Lancaster and Williams.) Eyes hurt and print blurred at end of half hour.

The following results bear out this conclusion: 69 percent of the records show no evidence of accommodation fatigue, that is, no decrease in the amplitude of excursion. The

time limit of ten or fifteen minutes was completed in 57.4 percent of the records while only 32.8 percent were stopped because of constant blurring of the test object.

4. Since general fatigue becomes a factor after fifteen minutes, it is not considered practicable, in most instances, to continue accommodation fatigue tests with the ophthalmic ergograph for a longer period. It is believed that a fifteen minute ergograph test will usually indicate patients who suffer primarily from accommodative asthenopia.

5. The high positive correlation of  $+0.69$  between the objective evidence of accommodation fatigue manifested by decreased amplitude of excursion and the subjective evidence of accommodation fatigue manifested by constant blurring of the test object, together with the differential tests including the use of a 1 mm. opening, indicate that the fatigue is accommodative rather than retinal.

6. There is no marked difference in the distribution of the normal or subnormal nearpoints of accommodation according to the Duane standard for age among the three groups of records (increased, constant, and decreased amplitude groups). The coefficient of correlation between the Duane standard for age and ability to complete a ten to fifteen minute ergograph test is  $+0.46$ . These results do not justify accepting the Duane

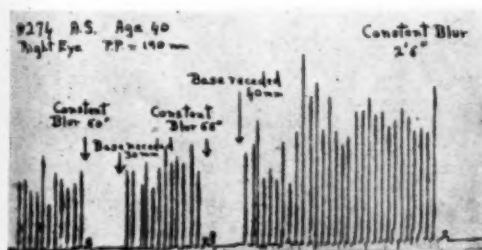


Fig. 20. Record showing the effect of withdrawing the test object from the eyes in order to differentiate accommodative from retinal fatigue. In record 274 constant blurring occurred in fifty seconds; with the test object recessed 30 mm. the test was continued for fifty-five seconds before blurring again occurred; with a second recession of the test object of 40 mm. test was continued for two minutes and five seconds before it was stopped because of constant blurring of the test object. Results point to accommodative rather than retinal fatigue since test object became clearer with each recession.

standard as a final criterion of ability to accommodate without rapid fatigue.

7. Records should be made with right, left, and both eyes whenever time permits, as marked differences are sometimes found in the three records.

8. Differences in records of accommodation fatigue and convergence fatigue made

with the ophthalmic ergograph should furnish a means of differentiating accommodative from convergence asthenopia.

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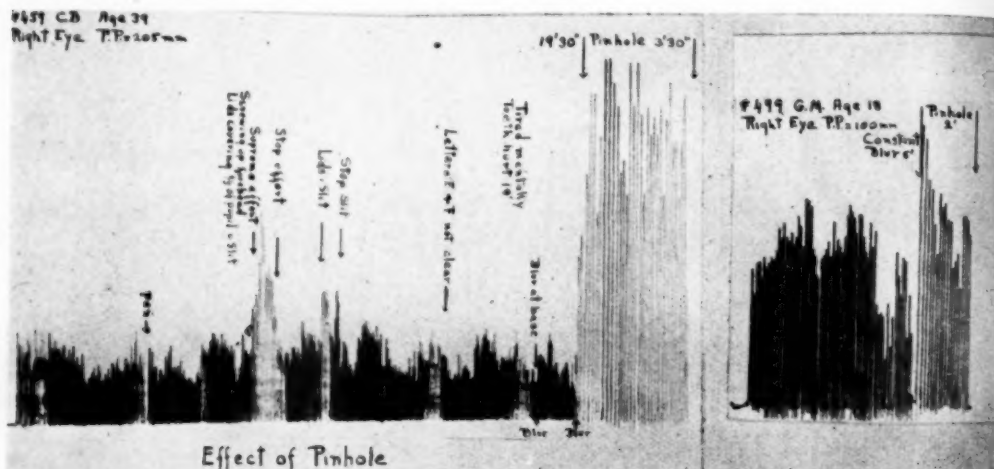


Fig. 21. Two records showing the effect of using a pinhole or stenopeic hole after constant blurring of the test object occurs, in order to differentiate accommodative from retinal fatigue. Ergograph record 499, Mr. G. M. Accommodation fatigue test right eye. Constant blurring of the test object in five minutes. Marked increase in amplitude of excursion with use of pinhole for two minutes.

Ergograph record 459, Dr. C. B. Accommodation fatigue test right eye, with correction. Excursions repeated as rapidly as possible. Note increase in excursion, two places indicated on record where eyelids were drawn to form a slit. Marked increase in the amplitude of excursion with use of pinhole for three minutes and thirty seconds after constant blurring had occurred after the test had been continued for nineteen minutes and thirty seconds.

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## NOTES, CASES, INSTRUMENTS

### SERPENT ULCER ACCOMPANYING ESERINE SENSITIZATION

MEYER WIENER, M.D.  
SAINT LOUIS

On September 3, 1931, Mrs. E. M., aged 62 years, consulted me on account of pain and blurred vision in the left eye. She gave a history of having been struck on the forehead by an automobile door on January 30, 1931, since which time she had suffered severe pain in her head and left eye. The general surgeon who was called, prescribed an ice bag and sent her to an eye physician, who prescribed glasses and also drops to be used three times daily in the left and once daily in the right eye. Our examination revealed the right pupil larger than the left. Tension in the right eye was 16 mm. Hg.; left eye, 30 mm. Hg., with the Schiötz tonometer. Fields of vision showed no contraction, no scotomata and no enlargement of the blind spots. The vision of the right eye was 15/16; with +1.0 D. sph. was 15/12. The vision of the left eye was 15/16+; with +0.50 D. cyl. ax. 180° was 15/12. There was normal muscle balance for distance, 3° exophoria for near; near point of convergence was three inches, near point of accommodation, eight inches, either eye with +2.50 D. sph. added to her distance correction. The fundi showed nothing abnormal. She was told to continue with her drops (eserine in oil) and operation on the left eye was advised.

On November 21, she returned with a severe dermatitis of all four lids. The conjunctiva of both eyes was red and thick, and there was pericorneal redness, but the irides were clear. The left pupil was very small. The tension of the right eye was 16 mm. Hg., the left 47 mm. Hg. Vision was 15/16 in each eye, with correction. Eserine was discontinued and adrenalin packs prescribed, to be used three times a day, in the left eye alone, also 5 percent ichthyol ointment for the lids and abstinence from water to the lids.

Two days later the tension in the left eye was 18 mm. Hg. The dermatitis was about the same. On November 27, the dermatitis was still severe but improving. The tension of the right eye was 12 mm. Hg., left 22 mm. Hg. She had used the adrenalin pack before the tension was measured. On November 29, I was called to the patient's home. The eyes were swollen almost closed, conjunctiva very red and much thicker, especially around the corneas, which were still clear. There was continued lacrymation and pain, but no evidence of iritis.

On December 1, the eyes were worse. There was a narrow ring ulcer near the corneal margin of the right eye, involving the outer and upper quadrants. A similar condition existed in the upper quadrant of the left eye, there being a round, larger ulcer slightly nearer the center, about 2 mm. in diameter. She was sent to the Jewish hospital immediately and given 25 million typhoid, paratyphoid bacteria intravenously. The injection was followed by chill and temperature rise to 102° F. Radiant heat was also prescribed and 1/2 percent optochin solution every two hours.

By December 4, the ulcers were healed. She left the hospital on the 5th. December 6, the eyes were still red and the lids rough and swollen, although less in amount. The same treatment was continued. On December 8, the lids were swollen almost closed and the conjunctivæ redder. I found she had resumed the use of the ichthyol ointment. We stopped this and prescribed zinc oxide ointment, continuing the heat and the optochin.

December 10, the eyes were opened wide and there was very little tearing. The conjunctivæ were much less red and thick. There was no pain, nor itching of the lids. The tension was 18 mm. Hg. in each eye, in spite of the fact that no adrenalin packs had been used since the ring ulcers developed. Another interesting phase of this case is the development of a sensitization to ichthyol

after it had had a soothing effect at first. The increased intraocular tension, which eserine failed to reduce, has seemingly been controlled by the use of adrenalin packs used only three times a day for three days.

Butyn also was found to produce severe reactions in conjunctivæ and skin of lids. After using butyn as an anesthetic for taking tension, a reaction always occurred, beginning almost at once, lasting from three to five days. No such reaction occurred after the use of holocaine for this purpose.

The case presents several interesting features: (1) Glaucoma following a blow on the head. (2) Sensitization to eserine, butyn, and ichthyol. (3) Typical ring ulcer which appeared during a reaction to the use of eserine and butyn. (4) Prompt healing of the ulcer after treatment with nonspecific protein in the form of typhoid-paratyphoid bacilli given intravenously and omission of the toxic agents. (5) Control of tension by the use of adrenalin packs without the use of any miotic.

900 Carleton building.

### CASE OF MEGALOCORNEA

L. L. McCoy, M.D., F.A.C.S.

SEATTLE

Mr. G. DuJ., a Frenchman, laborer, medium stature, 45 years of age, in good health, was first seen April 17, 1928.

His only complaint was poor vision in left eye for the past year. He claimed that he had always had large eyes and his vision was always very good up to April, 1927, when he was struck in the left eye by a fist during an altercation. He was in the French Army from 1914 to 1917 during which time he received a small shrapnel wound in the left eyebrow. He entered Canada in 1919 and had no difficulty in passing the entrance examinations. One brother two years older has a similar but less marked appearance of his corneæ.

Examination: Vision O.D. was 20/50+; O.S. was 20/200. The right vision was improved to 20/15 with -1.50 cyl. ax. 150°. The left vision could not be improved by lenses. He had been wearing O.D. -1.00 cyl. ax. 165°; O.S.

-1.50 cyl. ax. 180°. His muscle balance, conjunctivæ, lids, and lacrimal sacs were normal. His corneæ measured O.D., horizontal diameter 15 mm., vertical diameter 14 mm.; O.S., horizontal diameter 14 mm., vertical diameter 15 mm. Anterior chambers were very deep and clear. In average daylight, the pupils measured O.D., horizontal diameter 3.5 mm., vertical diameter 4.5 mm.; O.S., horizontal 4 mm., vertical 4.5 mm. The left pupil was somewhat irregular, there being a small deformity in the iris between "one and two o'clock" like a keystone in an arch. The irides were dark brown, the left showing slight atrophy. The pupils reacted well to light and accommodation. Tension by Schiøtz tonometer was O.D. 10 mm., O.S. 11 mm. Fields: O.D. normal; O.S. markedly contracted above. The lenses were clear except for several small dots of pigment on the anterior lens capsules probably of persistent pupillary membrane origin. There was a moderate number of dustlike and membranous floating opacities in the vitreous right and left. The right fundus was normal. The left fundus showed a very large retinal detachment below. No retinal tear could be found. Otherwise the fundus was normal. Transillumination was negative for new growth. Under oral administration of potassium iodide and the use of dionin locally, the detachment became less and less and at the last examination December 11, 1931, there appeared numerous small pigmented areas in the fundus with moderate retinitis proliferans below. There seemed to be slight improvement in the form field and fewer vitreous opacities. No doubt the retinal detachment occurred when the patient was struck in the eye one year previously, as his failure of vision dated from that time.

817 Summit avenue.

### UVEITIS DUE TO SINUSITIS

AMBROSE EARL EDGERTON, M.D.

SAN FRANCISCO

During the past twenty-five years a great deal of interest has been aroused concerning the relationship of focal infection to local and general disease. In-



fections of the sinuses are frequently found to be responsible for distant inflammations. The uveal tract is a frequent site for these and other focal infections because of its generous blood supply which appears to furnish a fertile soil for bacteria and toxins.

Uveal deposits, according to Fuchs, consist of an accumulation of cells, lymphocytes and leucocytes, agglutinated into masses by means of fibrin. Pigment granules are interspersed partly free and partly enclosed in the cells. These masses are at first suspended in the aqueous but by the movements of the eye are thrown against the posterior surface of the cornea and adhere there. Later the cells of the exudate disintegrate and become absorbed and the pigment granules are more clearly seen. In tuberculous uveitis, a mutton fat deposit may form on the posterior surface of the cornea but unless the deposits are of long standing they are conspicuous by the relative absence of pigment in their composition, according to Verhoeff.

The case here reported is interesting especially because of the astonishing rapidity of the general and local improvement after operation on the sinuses.

The patient, S. F., a woman 52 years of age, came to the office complaining of arthritis and poor vision. She had been suffering from arthritis for several years. Various vaccines had been administered as well as sodium cacodylate, activin, and sodium iodide. Her tonsils had been removed a few years ago. She had suffered a great deal of pain in her feet, ankles, hips and lumbar region, shoulders, arms and fingers. At times there had been some swelling of the joints associate with which pain was more severe.

The general physical examination was negative, except that a palpable tumor was found overlying the uterus. The Wassermann, blood count, and urine were normal.

Vision was 6/20 in each eye. The lids, conjunctivæ, and tear sacs were normal. Tension seemed slightly elevated to fingers. Pupils were 3 mm. in diameter, round, equal and reacted

slowly to light and accommodation. The anterior chambers were somewhat shallow. In the right cornea there was a small nebula at "four o'clock", the result of an old injury.

Examination with the loupe showed clear corneas (except for the small nebula on the right) but massive deposits on the endothelium. A few scattered opacities were noted in the lenses. In the vitreous bodies were many opacities. The discs were oval and of a yellowish-pink color, the edges being fairly well defined. The vessels were somewhat sclerosed.

Tension with a Bailliart tonometer was O.D. 40 mm., O.S. 44 mm. Slit-lamp study of the posterior surface of the cornea of each eye revealed masses of brownish-red deposits of various sizes, each one being surrounded by a paler area. Some of these deposits appeared to be as much as 1 mm. in diameter. Between the larger masses were many fine, brown, pigmented spots. The aqueous also contained many of these fine brownish granules.

Dr. A. W. Hebert found that the antrums were lined with thickened mucous membranes and polypoid tissue. Due to the severity of the uveitis and arthritis, it was decided to operate at once.

A radical antrum operation was accordingly done under local anesthesia. A degenerated and thickened membrane was found on each side. Both antrums were practically filled with polyps. Aerobic and anaerobic cultures were made, using different media, but no growths were obtained.

Visual fields were not taken before the operation but a short time afterwards normal fields for form and color and slight enlargements of the blind spots were found.

The patient left the hospital on the seventh day. At that time her vision had improved to 6/9 in each eye. On the third day after the operation all pains had disappeared from her joints, arms and legs, so she no longer suffered loss of sleep. Ten days after the operation she was able to go to the breakfast table for the first time in three years.

When the patient left the hospital, iodides were prescribed for internal use and mercury inunctions were ordered daily. Atropine was instilled once a day in each eye, and hot compresses used every four hours.

Two weeks after the operation, with the following correction the vision in each eye was 6/6: O.D. +1.75 D.sph. =—.50 cyl.ax. 180°; O.S. +.75 D.sph.

At this time the tension, taken with a Bailliant tonometer was 30 mm. in each eye. Slitlamp examination revealed the corneas to be much clearer, but the anterior capsule of the left lens showed several deposits, in clump formation, about 1 mm. in diameter, of a rich reddish brown pigment, located on the nasal side. The areas of punctate keratitis were then free from pigment. There were no synechiae. The pupils were round, equal, free and reacted normally to light and accommodation.

The uveitis in this case had been present for some time and the low grade toxemia was not active enough to lead to rapid destruction of the eyes.

Rosenow believes, from his experiments, that localization of bacteria or their toxins in the uvea is very frequent in cases of uveitis, and that microorganisms have specific affinity for the eye, causing ocular disturbances. In some experimental cases, he was able to recover the organism itself from the intraocular lesion and either the toxin or bacteria recovered from the primary lesion produced a similar eye condition in some inoculated animals.

In such cases as the one described I believe that all sinuses should be explored by an expert, for one never can tell exactly which sinus is at fault or whether they all are causing the trouble.

450 Sutter street.

## NOTES ON ANGULAR CONJUNCTIVITIS

OLIVER P. BOURBON, M.D.  
LOS ANGELES

There are two points of value in the clinical diagnosis and treatment of angular conjunctivitis that the writer has not seen mentioned in textbooks or other literature. Attention is called to the scanty secretion, but not to the fact that the secretion is usually stringy. The amount is frequently so slight that none will be seen on ordinary inspection, but if a sterile wood applicator is touched to the caruncle or extreme inner angle of the lids, the secretion that may not be seen will adhere to it and may be drawn out in a string an inch or more in length. This type of secretion has been examined microscopically many times, both when other symptoms of the disease were frankly present, and in doubtful cases. The Morax-Axenfeld bacillus was found so frequently that a stringy secretion should be considered an important symptom in making a clinical diagnosis.

In addition to the usual home treatment by the instillation of a solution of zinc sulphate into the conjunctival sac, zinc ionization at the office is very effective and will materially shorten the course of the disease. This is given in the following manner: One instillation of a four percent solution of cocaine is made. Two pads of absorbent cotton are moistened with a one or two percent solution of zinc sulphate. Two drops of this solution are instilled into each eye, and the moistened pads of cotton are placed over the eyes. A double zinc electrode which is attached to the positive pole of a galvanic current, is placed on the pads. The negative electrode is placed over the nape of the neck, and a current of two or three milliamperes is applied for ten minutes. This treatment should be given daily or on alternate days.

520 West Seventh Street.

# SOCIETY PROCEEDINGS

Edited by DR. H. ROMMEL HILDRETH

## CHICAGO OPHTHALMOLOGICAL SOCIETY

November 16, 1931

DR. FRANK BRAWLEY, president

### Recurrent oculomotor paralysis of left eye

DR. M. L. FOLK presented a woman sixty-nine years of age, who came to Michael Reese Hospital in December, 1928, complaining of diplopia and ptosis. Five years previously she had had a similar attack lasting four or five weeks from which she gradually recovered. There was complete ptosis, diplopia, and paralysis of the extraocular muscles supplied by the third nerve; facial paralysis since 1923. She was seen again in 1929 when the ocular movements were normal. She returned in June, 1931, complaining again of diplopia of ten days' duration. Examination revealed left ophthalmoplegia externa. This lasted until two weeks ago when she reported that it had disappeared. It was apparently a lesion of the pons of vascular origin, as the patient was an old arteriosclerotic. It would be interesting to know why the lesion always affected the same spot.

In 1894 Jeffers collected thirty-nine cases from the literature. How many had been reported since was not known, but it was apparently a rare condition. With this patient each succeeding attack lasted longer than the previous one. The first attack lasted only three or four weeks, the last one six months.

**Discussion.** DR. E. V. L. BROWN mentioned a case seen at Billings Memorial Hospital, having a vascular lesion with a proptosis of the left eye, which had a considerable period of remission. It was based upon a hardening of the anterior cerebral artery behind the left orbit, with a large area of the wall destroyed by erosion. Dr. Louis Pollock and Dr. Percival Bailey had seen this case.

### Detachment of the retina

DR. THOMAS D. ALLEN showed a man who had been shot in the face with birdshot over four years ago. The x-ray picture taken at the time showed only two or three shot within the orbit. The shot had probably not penetrated the right eye itself, but bruised it from the outside; one had penetrated the left eye.

When first seen there was light perception, occasional hand movements, in the right eye; tension —1. There was a clear cornea, the anterior chamber was slightly shallow, pupils semi-dilated, some peripheral opacity in the lens, a faint red reflex at one side. There seemed to be some grayish membrane at the side and back of the lens over the ciliary body. The left eye was shrunken; tension —3.

The electric cautery was used at "7 o'clock" about 12 mm. from the limbus. The cautery point was introduced until the subretinal fluid escaped, then withdrawn and introduced again for about one-half second. This seemed to result in enlargement of the red reflex. About eleven days later a trephining was done at "5 o'clock". The technique was changed because there was apparently little result from the first operation. It was repeated one week later at "4 and at 8 o'clock". Diathermy was next tried, since little had been accomplished by the other procedures.

The patient left the hospital October 11. There was some red reflex in the upper portion of the retina, more than there was at present, possibly occupying 6 or 8 disc diameters, and just below it a white streak in the retina. Below, there could be seen some blood vessels crossing over a gray membrane, possibly the retina. It was hoped that this would contract and pull the retina down. Unfortunately there had been little improvement. When the retina had been detached for over three years there was not much to hope for.

**Discussion.** DR. HARRY W. WOODRUFF

remembered seeing this patient in 1927. At that time it was evident that shot had penetrated both eyes. X-ray localization showed no shot in either eye. He had at one time vision of counting fingers at six feet on the temporal side in the right eye. There had been much blood in the vitreous, which cleared to some extent, with treatment, in the hospital.

There was nothing to lose in this case, and Dr. Allen was to be congratulated on trying to do something for the retinal detachment. All these cases should be reported where operative procedure had been used for retinal detachment, as the subject was of great importance and favorable results were being reported.

DR. E. V. L. BROWN spoke of a series of cases of retinal detachment at Billings Hospital, upon most of which Dr. Kronfeld had operated. The first case had been detached over seven months. Not many had had more than one operation, but in a series of seven or eight some had had useful vision restored for considerable periods.

DR. HARRY GRADLE mentioned a fairly large series of cases upon which Gonin's operation or some modification thereof had been performed over a period of two years with a comparatively small percentage of good results; certainly not more than 15 percent. On the other hand, there were cases in which there had been a restoration, both anatomical and functional, some following simple puncture, and some that re-attached spontaneously. The tear in the retina did not seem to play the rôle that Gonin ascribed to it. One patient who refused operation had a spontaneous re-attachment, although a tear was present.

A recent article in the British Medical Journal had the conclusion that the benefit derived was due to the thermic reaction between the choroid and the retina, regardless of the hole. It was true that by using the Gonin procedure or some of its modification, we were obtaining more results in the detachment of the retina than we had in the past, but the question was still un-

settled, and it was impossible to pass judgment from the limited number of cases available. Much more experimental and clinical evidence was necessary before conclusions could be reached.

#### Lime burn of the cornea

DR. C. F. SCHAUB presented a case from Dr. Suker's service at Cook County Hospital. This man, who had a lime burn of the eye about ten days ago, was seen within an hour after the accident. There was a terrific chemical reaction of the eye and a large denuded area of conjunctiva. The next morning adhesions were forming between the opposing surfaces of the bulbar and palpebral conjunctiva. Various forms of treatment were tried to prevent adhesions, but as fast as freed they would form again. Dr. Suker suggested putting a shell in the conjunctival sac, which was done after the eye was cocaineized. A large shell was used, with sufficient excavation underneath so as not to touch the cornea, and this was well tolerated. The prothesis was kept in the conjunctival sac for one week, being cleansed and reinserted daily. As a result there were no adhesions, and the cornea had cleared up as well as could be expected with that type of burn.

#### Various types of ophthalmic lens corrections

DR. MAX POSER read a paper on this subject which will be published in this Journal.

*Discussion.* DR. HARRY S. GRADLE said that spectacle lenses had but one purpose, namely, the endeavor to correct ametropia which might be either spherical or astigmatic or a combination of the two. In dealing with pure spherical ametropia, the problem, although complex enough, was much simpler. If the eye were to be held in the primary position so that the optical axis coincided with the optical center of the spectacle lens, the troublesome factor of spherical aberration would not arise, for spherical aberration in the human lens within the pupillary zone was a negligible factor, and out-



side of the pupillary zone was cared for by the diameter of the pupil itself. But the spherical aberration of the spectacle lens, when the eye deviated from the primary position, increased rapidly toward the periphery, the degree increasing as the square of the aperture of the lens and as the cube of its refracting power. As a result, a +20 D. lens had a refracting power near the edge of a +25 D. lens. But in addition to purely spherical aberration, an obliquity of the axis of the lens with the optical axis resulted in an astigmatism of the oblique bundle with a consequent defect in the image known as side-flair or coma. The wider the angle of the lens, the greater was this defect, which was somewhat controlled by the diameter of the pupil.

When there was added to the spherical lens, the cylindrical correction necessary to correct corneal or lenticular astigmatism, the calculations of the peripheric lens surfaces required a mathematical wizard; it was no wonder that eight years were needed. These corrections must needs be accurate, for as far as could be shown, there was no positive proof of "astigmatic accommodation". Deviations from spherical emmetropia in the majority of cases could be counterbalanced within limits by involuntary accommodation, but this did not hold true where the astigmatic error was greater than one-half diopter.

Were the eye an accurate optical instrument, the ultrarefinements of closely calculated spectacle lens curves would be absolutely essential for useful vision. But fortunately the elements of accommodation and compensation entered, and the eye was able to take care of minor defects of refraction and of optical imperfection and the final question came down to the resolving power of the eye. This of course varied with the wavelength of the light used, the intensity of the light, and the size of the pupil. The angular measure of the resolving power of the eye was directly proportional to the wavelength and inversely proportional to the diameter of the entrance pupil. Thus

with yellow light of 5800 Angstroms and an entrance pupil of 3 mm. the resolving power presented an angular measure of  $0.82'$ . So that in calculating spectacle lenses, the makers must keep in mind that for visual acuity many factors must be considered, one of them being the monochromatic aberrations. Dr. Poser had shown how these were corrected in the modern spectacle lens, and we must only make sure that the nicety of correction was not carried beyond the point of appreciation of the human eye.

DR. ROBERT VON DER HEYDT wished to ask one question. Dr. Poser had said that "corrected" lenses could not be corrected for both sphere and cylinder—"you must choose one or the other". How should a lens for this correction be ordered: O.D. +4. D.sph. = +.50 cyl. ax.  $90^\circ$ ; O.S. +0.50 D.sph. = +4. cyl. ax.  $90^\circ$ .

If the Bausch & Lomb lens was corrected only for sphere, one would be placed in the dilemma of having to order the right lens of this prescription from Bausch & Lomb and the left from somebody else. It would be preferable to order this prescription properly in corrected lenses from one manufacturer. He should then entirely discontinue the manufacture of toric or other less perfect lenses.

DR. THOMAS D. ALLEN said that in cataract cases a good deal of astigmatism was frequently shown. Suppose it was found that +8.00 D.sph. = +4.00 cyl. ax.  $180^\circ$  was necessary for the distance vision, and adding +3.00 would give +11.00 D.sph. = +4.00 cyl. ax.  $180^\circ$  for near. With an ordinary lens did the patient have before his eyes +11.00 D.sph. = +4.50 cyl. ax.  $180^\circ$ , or +11.00 D.sph. = +3.50 cyl. ax.  $180^\circ$ ? Some doctors were in the habit of ordering less cylinder for near than for distance in such an instance.

DR. MAX POSER replied that all orthogon lenses, whether spheres or spherocylinders, were corrected lenses; spherocylinders were corrected as well as spheres. Sphere and cylinder could not be corrected simultaneously in a spectacle lens; Bausch & Lomb lenses were

corrected for cylinder (not for sphere as Dr. Von der Heydt said). The use of these terms was indeed confusing, since they were each used in several different ways. In this connection they were not used as the names of kinds of lenses, but in a manner already explained; whenever an eye looked obliquely through a spectacle lens, the effect of the lens was that of a spherocylinder no matter whether the lens was only a sphere or was a spherocylinder. The correcting effect of the lens at the point in question or for the angle in question, then, could be expressed as a sphere plus a cylinder. In correcting spherocylinder lenses, we reduced the cylinder effect of oblique pencils to zero, so that the lens acted like a sphere wherever the eye might look. In correcting spherocylinder lenses we aimed at making the cylinder effect of oblique pencils the same as the cylinder at the center of the lens. Each type was corrected to the highest possible degree. Anyone could prescribe orthogon spheres or spherocylinders with perfect confidence that he was giving his patient the best there was.

With reference to Dr. von der Heydt's wish that manufacturers should discontinue ordinary toric or other less perfect lenses, that of course depended largely upon what lenses were prescribed by the ophthalmic profession; the manufacturer would not be justified in doing so as long as the profession prescribed lenses of the noncorrected type.

Dr. Poser replied to Dr. Allen that in such an instance with the ordinary lens there was a greater cylindrical effect at the periphery than at the center; therefore there was some justification for reducing the strength of the reading cylinder unless a corrected glass was ordered. In cataract cases where we dealt with high plus powers, uncorrected lenses of a  $+8.00$  D.sph. =  $+4.00$  cyl. ax.  $180^\circ$ , with the line of sight inclined about 15 degrees downward in relation to the ophthalmic lens, this lens would present to the eye of the observer a cylinder of 5 diopters

and with the increase of the inclination of the line of sight toward the lens the cylinder power would increase considerably. If corrected lenses were prescribed no change in cylinder should be made. If ordinary flat spherocylinders were used, it was obvious that the lens would provide more cylinder correction than was needed when looking obliquely through it. Since the obliquity would not be constant but vary from zero to possibly 30 degrees, compensation by arbitrarily deducting from the cylinder power did not look practical. The only satisfactory procedure was to prescribe corrected lenses.

#### **Heteroplastic ossification: a report of two cases of bone formation in the choroid**

Dr. Theodore M. Shapiro read a paper on this subject which will be published in this Journal.

ROBERT VON DER HEYDT,  
Secretary.

### **ROYAL SOCIETY OF MEDICINE, LONDON**

#### **Section of Ophthalmology**

November 13, 1931

MR. ELMORE W. BREWERTON, president

#### **Sarcoma of the choroid**

MR. HUMPHRY NEAME showed a case that he thought merited being diagnosed as a malignant growth because of its solidity, its increase in size in a fortnight, the presence of irregular pigmentation on the lower surface, and the numerous vessels. Two years ago the patient noticed that she had a different color perception in the two eyes; on looking at yellow flowers, one eye saw them much paler than the other. Also, with the good eye covered her medicine bottle looked smaller than with both eyes. That indicated a definite pushing forward of the retina by the growth. She had been slightly myopic in that eye, but now she had 4 D. of hypermetropia. Mr. Neame said

he intended to remove the eye on the following day.

#### **Tuberculous dacryo-adenitis**

MR. FOSTER showed a patient who had, on admission six weeks ago, a painful eyelid. Later a swelling appeared on the lower lid, but the sample of pus from it was lost when it was opened. Von Pirquet test produced a strong reaction and an increased swelling. It was therefore assumed to be a tuberculous dacryo-adenitis of the upper lid. The patient had been struck on the eyelid by a tennis ball but no cut resulted.

*Discussion.* MR. J. H. FISHER thought a small foreign body possibly could be found at the bottom of the sinus, which might have been driven in at the time of the accident. He suggested making a semicircular incision around the outer canthus and exploration. A lacrymal gland was not necessarily the cause of the trouble.

#### **Worm in the anterior chamber**

MR. M. S. MAYOU showed a man who, while fighting in Gallipoli, was struck by a fragment of exploded shell. His first appearance for advice was when he attended at the Central London Ophthalmic Hospital to be tested for glasses. The presence of a worm in ordinary tissues resulted in a calcareous condition of the surrounding tissues, but that did not necessarily apply to the anterior chamber.

*Discussion.* PROFESSOR R. T. LEIPER (parasitology) said there was nothing to indicate that the worm was not present before the injury; it might have been in the eye previously and have become involved in the scar tissue which formed as a result of the accident. It was unusual to find parasites in the anterior chamber of the eye, and none of the cases of the kind on record had been fully studied by medical zoologists. Viewed with his own lens this object seemed to resemble closely a nematode. One end of the worm, however, seemed to be coiled on itself. Worms were sometimes found in the

anterior chamber of the eyes of horses, but the life history involved biting by an insect. This man might have been bitten by an insect while in service.

#### **Cataract in an acetone factory**

MR. MAYOU showed a boy, eighteen and one-half years of age. His work was that of paint-sprayer, but he had only been doing this six months. He complained when seen, that his vision had been blurred seven weeks. Apparently the cataract had occurred while the boy was at work. In the right eye was a typical diabetic cataract. In the other eye were capsular changes all around the lens. A month after ceasing work there was no acetone and no sugar in the urine.

*Discussion.* MR. BREWERTON thought that if this kind of painting caused cataract such cases should be much more common.

#### **Gonorrheal conjunctivitis**

MR. LINDSAY REA showed a nurse in the Lock Hospital who contracted blenorrhœa in the course of her work. Gonococci were freely present in the pus from both eyes. In ten days she was rid of her discharge and was cured, the only treatment carried out having been almost continuous irrigation with ten percent magnesium sulphate.

*Discussion.* SIR ARNOLD LAWSON submitted that the antiseptic property of the substance used was not the important thing; it was the irrigation, so that no discharging pus should be given the opportunity to settle and do mischief in the eye. He had brought such patients practically out of danger in 48 hours by putting on relays of nurses to irrigate, first every half-hour, then every hour.

MR. MAYOU, speaking of an experience of some 250 cases of gonorrheal infection of the eye every year, agreed that in the early acute stage silver nitrate should not be used, only mild washes; but he found silver nitrate useful at the later, the clearing-up stage. It was also valuable to fill the

conjunctival sac with acriflavine, of one in fifteen hundred strength, in castor oil. This protected and lubricated the cornea.

#### **Epibulbar growth (two cases)**

MR. C. GOULDEN showed a man seventy-six years of age who twenty years ago had an epithelioma removed from his lip, and glands were dissected from his neck; also two growths had been removed from his left cheek, probably rodent ulcers. The cornea had become opaque in front of the edge of the growth. The second patient was a man aged eighty-one years; and his growth was much the larger of the two. It was very vascular.

*Discussion.* MR. BREWERTON agreed that both the cases were malignant, and advised removal without delay.

MR. TREACHER COLLINS spoke of a case in which, instead of removing the eye as desired, he cut the tumor off as close to the cornea as he could, and then had it treated with radium. He followed the case for a long time. There was no return of the growth, and a beautiful scar was left. Eventually the man died of a different disease. The hard tissue of the cornea resisted the downward course of the growth for a long time; these growths tended to spread over the surface and backwards into Tenon's capsule. Or if they got into the vessel, they might spread into the canal of Schlemm.

#### **The use of antiseptics**

MR. FREDERICK RIDLEY read a paper on this subject. Confining oneself to the problem of destroying demonstrable bacteria in the conjunctival sac, the problem could be stated as follows: Would the antiseptic destroy the organisms before it was rendered ineffective by dilution in the tears? Secondly, during what subsequent period would it inhibit the growth of the organism, taking into account the further dilution? Thirdly, did the antiseptic destroy the natural protective agent lysozyme? And, further, if so, was this effect operative in greater dilution than was at least inhibitory to the bac-

teria? An experiment, which Mr. Ridley detailed, showed that, even in the normal eye, and with the minimum of irritation, the fluorescin which could be introduced into the conjunctival sac was diluted 32 times in eleven minutes. This rate of dilution followed an arithmetical progression, i.e., a fixed quantity of fluorescin by weight was eliminated in a unit of time. This rate of dilution applied to the dyes which were absorbed, most substances, e.g., argyrol, were diluted in geometrical progression, approximately one-half every forty seconds. The medium in which the antiseptic had to act was also fixed, except in the case of prolonged irrigation when using an undine or eye bath. It was almost identical with normal saline to which had been added ten percent of serum.

Mr. Ridley tested many substances, including zinc sulphate, perchloride of mercury, biniodide of mercury, sulphate of copper, silver nitrate, coll. argentum, carbolic, argyrol, protargol, boric, eusol, cocaine, and mercurochrome. The microbes tested were staphylococci and streptococci. All substances were tested in a medium comparable to tears, and only silver nitrate destroyed the organisms in the time available before it was rendered ineffective by dilution in tears. Silver nitrate applied in one percent or two percent strength might destroy the organisms with which it was brought in contact. Usually the beneficial action of silver nitrate was ascribed to the desquamation it caused, and it was said it could have no antiseptic action since it was converted into the insoluble chloride by the sodium chloride of the tears and tissues. In his experiment it was in the form of chloride, and was combined with protein, but it was, none the less, a very effective germicide.

Perhaps a substance introduced into the conjunctival sac might prevent the growth of organisms in it for a considerable time, in spite of the dilution. It became evident that only silver nitrate, protargol, and argyrol were likely to possess value under this heading.



Silver nitrate was capable of inhibiting when in great dilution, but it was precipitated in the superficial layers of the conjunctiva, and could reasonably be assumed to exert a powerful inhibiting action until the desquamating cells were themselves washed away.

Silver nitrate destroyed the lysozyme in high dilution, but a concentration of 1 in 25,000, which was actively inhibitory, did not appreciably affect the bactericidal power of the tears. Neither argyrol nor protargol destroyed lysozyme.

The object of this enquiry, Mr. Ridley said, was to determine by experiment what was the value of the antiseptics being commonly made use of. They had been tested only on staphylococci and streptococci, and their value was only ascertained in the free fluid of the conjunctival sac and on the surface of the conjunctiva. With those limitations in mind, it could be said that only silver nitrate, argyrol, and protargol had any antiseptic action, and the first named was by far the most efficient. The research suggested that silver nitrate could beneficially be used in much weaker concentrations than those usually employed. In that case the pain associated with its use could be practically eliminated.

*Discussion.* Mr. BREWERTON said he was glad to hear that the old-fashioned remedy silver nitrate was still useful. He was strongly in favor of very weak silver nitrate; he often painted lids with it, of a strength of one grain to the ounce, and he found it very useful.

SIR ARNOLD LAWSON remarked that Mr. Ridley's paper seemed to confirm what he, the speaker, said earlier in the meeting that for suppurative conditions in the eye antiseptics were useless. He might try that substance in a strength of 1 in 100 to see what would happen. Of the antiseptics he was most interested in, flavine, he regarded as an inhibitor. He did not think that either acriflavine or proflavine were of any practical use when infection was established, for then the infection must, largely, run its course. Salines and other nonirritant substances were as

good as anything else for irrigating the eye. His custom was to dress his cataract cases with flavine; he placed gamgee tissue soaked with it over the eye, and changed it twice a day, as it prevented the ciliary borders from becoming dirty. He practically never experienced dirty lids.

MR. M. S. MAYOU said he had frequently taken cultures from the conjunctival sac before doing a cataract operation, and often found staphylococcus present. Treatment with protargol did not get rid of this infection. But the operation went well in spite of the infection. The secret lay in the fact that not every part of the conjunctiva contained the same number of organisms. He had found, in an investigation twenty years ago, that the upper fornix was practically always sterile, the washing of it by tears seemed to keep it clean. The lower conjunctival sac and the caruncle always bore organisms.

*(Reported by H. Dickinson.)*

## ST. LOUIS OPHTHALMIC SOCIETY

November 27, 1931

DR. M. HAYWARD POST presiding

### Industrial eye work

DR. ROY E. MASON read a paper on this subject.

*Discussion.* DR. JOHN GREEN said that eye accidents being largely industrial were therefore preventable. He considered the blanks submitted by insurance companies and by the Workmen's Compensation Commission unsuitable for reporting eye injury cases and suggested a special blank for this purpose. He thought the compensation act had reduced the number of suits for injuries and felt that the commission was apt to resolve the case in favor of the injured when conflict of medical opinion existed. The award for total loss of an eye seemed hardly adequate, being the weekly wage multiplied by 120, amounting frequently to two or three thousand dollars. The tendency of the laity to attribute defects of vision to

injury might result in a claim referring to some antecedent injury. Dr. Green said that the question of former disease as a cause of loss of sight was a matter on which different examiners might sincerely hold different opinions. The oculist who had had the care of the eye from the time of injury was in the best position to decide the question. Dr. Green thought it rather surprising that compensation commissions had not accepted the views of ophthalmic surgeons as embodied in the report of the Committee on Industrial Eye Accidents of the American Medical Association. The Committee had been disinterested; had worked from a scientific standpoint trying to arrive at the truth; and had not been partisan to either employer or employee. He thought the attitude of the Missouri Compensation Commission in holding vision without correcting lens as the standard for determining the degree of visual loss rather ridiculous from the viewpoint of ophthalmologists. A man with myopia might have uncorrected vision of 20/150 or less which should certainly not be regarded as his true vision.

The fact that we had no standard near vision test had been pointed out by the essayist. Dr. Green had been unable to find the exact meaning of the notations 0.37 D, 0.50 D, and so on, as used on the Bausch and Lomb near vision test card he had been using. He asked which type subtended an angle of five minutes at fourteen inches.

He agreed with the speaker that the immediate history given by the patient before he had thought of the legal aspects of the case was most important. He recalled a patient with a gunshot injury of one eye. The uninjured eye had had a vision of 20/200. The history revealed that this eye had crossed since childhood and had been neglected.

He regarded a diagram of the injury as desirable and x-ray pictures necessary where even the remotest suspicion of intraocular foreign body existed, recalling cases where failure to make such examination had been disastrous. The necessity of making a refraction test, diplopia tests and taking visual fields at time of dismissal was

mentioned. He advocated a protective dressing in every case after removal of a foreign body from the cornea even if merely the epithelium was broken. For abrasions, chemical burns and burns with hot metal, such as curling tongs, he had found an ointment of holocain and hyoscin very efficient.

The malingerer claiming loss of vision in both eyes might be detected by observation of his attitude and behavior when he was unaware of being observed.

The determination and recording of the vision of every candidate for a job would save insurance companies and employers a great deal of trouble in case of accident to the eyes.

The fact that no account was taken of paracentral scotomas in the estimation of percentage of visual loss by the commission was mentioned.

DR. C. W. TOOKER thought Dr. Mason's paper timely and interesting. He thought it worth while for all oculists to read the law which creates the commission, as under it the commission can establish its own standards and rules. He mentioned the fact that myopia usually was bilateral and that the commission held that the vision of the uninjured eye without glasses was the standard for that individual. He did not agree with the idea of taking visual acuity records in a recently injured eye as it might make the patient think he was seriously injured. The vision might be temporarily impaired where no permanent disability would exist. Visual acuity tests, he thought, should be made after the eye had become quiet.

DR. F. O. SCHWARTZ thought it behooved us as oculists to meet the commissioners, when necessary, with adequate preparation; that we should anticipate what might be asked and leave no stone unturned in the examination of the patient lest we be tripped up on some unexpected question, not only about the ophthalmic examination but about other related subjects.

DR. WILLIAM F. HARDY said that detection of the intelligent malingerer was tenfold more difficult than dealing with the ignorant. One method described by Lloyd he thought very good.

The patient was given an ordinary stereoscope and shown that the right hand image was seen with the right eye and vice versa. When this was firmly fixed in the patient's mind he was given the Bishop Harman test in which the conditions were reversed. The patient, unless very astute, would be caught. The addition of a bar reading test was recommended as giving two methods of examination without change of apparatus.

DR. E. C. SPITZE stated that formerly the Illinois Commission had assumed that the physician testified for the company who employed him. The Commission, after being corrected in this, had finally come to accept the doctor's written reports and frequently had given awards on the basis of these. He thought the Missouri Commission would eventually come to a similar stand.

DR. W. E. SHAHAN said, on the reading test, the designation D 0.50, D 2.0, and so on, was an arbitrary scale made for the benefit of the optician. If the patient read D 2.0, that would be a presbyopic individual requiring a two diopter lens for normal vision. The same enumeration was used for distance. Instead of indicating the distance at which the lines stood it indicated the lenses that would be necessary for a myopic or a hyperopic patient to see those letters, so if he read a certain line the examiner knew he required a certain lens to give normal vision. The examiner would then put down the number of the lens instead of the number of feet.

He said that the best reading test, prepared by the American Ophthalmological Society some years ago, had now become obsolete, and was no longer available. The best recent ones indicated the distance at which the figure was read to subtend standard angles. Very fine print was required to subtend the standard angle at fourteen inches. He thought there was a field for some one to prepare a proper reading test. He said Jaeger had collected specimens of all the type then used and numbered them from the smallest to the largest, which notation was still used.

DR. ROY E. MASON, closing, said that

insurance companies asking for a special report expected the ophthalmologist to write a letter without regard to blanks. While the award for the loss of an eye might not seem to be enough, it was fixed by the law. He said that the Commission, while not following the American Medical Association committee report entirely, did follow it largely, but would step up some of the losses.

The fact that awards would not be made on a basis of vision with a correcting lens was offset by using the uncorrected fellow eye as standard and this worked out fairly well.

The type which subtended a five minute angle at 14 inches was the D 0.37 type but doubted whether it was a correct test for normal near vision as he himself had difficulty reading 14/14 with that as standard, the print being so small as to make it difficult to distinguish the letters. He found Jaeger No. 2 about the smallest one he could satisfactorily use.

He had found malingering of loss of vision of both eyes most difficult to deal with and sometimes hospitalized such patients and had them watched.

When called to court the oculist should know the muscle balance, the near and far visual acuity; the commission would calculate the percentage of loss.

### Ocular pemphigus

DR. WILLIAM M. JAMES presented a communication on this subject and exhibited two patients having this disease. This paper will be published in the American Journal of Ophthalmology.

*Discussion.* DR. W. F. HARDY said he was glad to see these two cases which he was convinced were true examples of pemphigus. He had been dubious about the woman until he had seen her mouth. He said it was common in cases of pemphigus that other mucous membranes be involved, especially the nose, throat, and mouth which in many might be partly closed, or even completely obstructed.

He and Dr. Lamb had reported two cases fourteen years ago. Their cases had been farther advanced than the

present ones which he believed to be of more recent development, but a year from now he would expect tremendous progress in the condition of these. He noted the marked development at the inner canthus of one patient and predicted a future proliferation here and perhaps at the outer canthus, this being one differential point from trachoma, for which the disease was often mistaken. In their study Hardy and Lamb had had seventy-six references and had found the incidence to be one in twenty thousand. One of their patients, a boy, had been totally blind, the other, aged seventeen years, was blind in one eye and had 3/75 vision in the other, which was getting worse. In one there had been a history of congenital syphilis, considered coincidental. Syphilis and vaccination were often regarded as etiologic factors. Dr. Hardy urged Dr. James to follow these cases to watch development but believed all the ingenuity he might use would not change the course of the disease.

DR. H. D. LAMB said the basal histology of pemphigus was not an aid in differential diagnosis as it showed a chronic infiltration of subepithelial structures which lead to formation of cicatricial tissue with subsequent shrinkage. Due to its delicate covering epithelium true vesicles of the conjunctiva did not usually form.

DR. JOHN GREEN inquired if surgical measures had been attempted in more desperate cases.

DR. WILLIAM M. JAMES, closing, said that most of the cases reported in the literature were in late stages and surgery had frequently been tried, especially the use of epithelial graft to replace the conjunctival sac. The contraction of the underlying scar tissue had caused obliteration of the restored cul-de-sac and the attempts usually had been unsuccessful.

One of his cases had shown a low phytopharmacological index suggesting a toxic condition, and he had given this patient autohemotherapy with no evidence of recession of the disease. Radium was being tried at the time of the report.

### Nodular keratitis

DR. LAWRENCE T. POST presented two cases of this disease after reviewing the literature on the subject.

The first patient was the son of the second. He was 28 years old, in good health though slightly under-weight. Vision was 6/30 in the right eye and 6/20 in the left. Sight had begun to fail at 19 years of age.

All laboratory tests including Wassermann, tuberculin, dental, x-ray, sinus examinations and basal metabolism, were normal.

Ultraviolet radiation and thermophore treatment had not been of benefit.

The second patient was not presented in person. She had been seen on only one occasion. Her eyes showed a condition similar to that of her son but more advanced, vision being 6/120 in each eye. A daughter was reported to have had similar trouble.

*Discussion.* DR. JOHN GREEN spoke of a case to which Dr. Post had alluded in his paper. He said it was a case of distinct nodular opacity of the cornea. The nodules had been bilateral, as he believed them always to be, and larger than in Dr. Post's case. There had been a translucent grayish opacity between nodules, without lattice work. Tuberculin therapy had been followed by some improvement in vision, possibly not due to the tuberculin. He said there was little evidence that tuberculosis was the cause but that the slit-lamp studies had established the essential identity of lattice and nodular keratitis.

B. Y. ALVIS,  
Editor.

### MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

December 8, 1931

DR. J. F. RAMSAY presiding

#### Halle-West dacryocystorhinostomy

DR. SAM H. SANDERS presented Mr. J. M. I. aged forty-seven years, who had been suffering from epiphora for over 17 years. For ten years there had been



periodic swelling in the lacrimal region, accompanied by pain and sometimes by elevation of temperature. The patient received treatment from time to time. For the past two years the sac had ruptured externally many times and thick yellow pus had been evacuated.

A Halle-West operation was performed on December second. The sac contained thick yellow pus. The sac had been probed and irrigated twice since the operation.

*Discussion.* DR. W. L. SIMPSON outlined the technique of the Halle-West operation stating that no sutures were necessary, the operative time was short and the patient suffered little postoperative inconvenience.

#### **Bourguet dacryocystorhinostomy**

DR. E. C. ELLETT presented Mr. F. P. aged forty-five years, successfully operated on by the method of Bourguet for chronic dacryocystitis. He was under treatment for some years for this condition, always refusing operation. In August, 1931, there was an acute exacerbation of his infection and on October 22, he submitted to external operation. The procedure resulted in complete relief of symptoms.

Dr. Ellett reviewed the various methods of lacrimal sac operation stating that in his hands all intranasal operations had proven unsuccessful. In the past two years he and Dr. Rychener had completed a series of six external operations by the above technique and

although the operative time was longer than by the intranasal method, all had resulted in perfectly satisfactory cures.

#### **Congenital cataract and high esotropia**

DR. C. P. BAUSCH (by invitation) presented D. S., aged fourteen years, white female, blind in the right eye since birth. Examination July 28, 1931, showed O.D., cataractous lens, with vision of light perception. Convergent strabismus of 50 to 60 degrees. O.S. fundus examination normal. Vision was 20/20.

On August 4, 1931, a resection of the external rectus muscle and a 5 mm. recession of the internal rectus muscle and a needling of the cataractous lens of the right eye was done. Secondary glaucoma developed, and a linear extraction was performed August 7, 1931. Because the strabismus was undercorrected a resection of the external rectus of the left eye and a recession of the internal rectus of the left eye was done September 25, 1931. A spasm of the right inferior oblique muscle evidenced itself following these procedures and on October 27, 1931, the right internal rectus was lengthened by means of two angled incisions, and the right inferior oblique muscle was tenotomized through the conjunctiva. On November 3, 1931, the internal rectus of the left eye was lengthened by means of angled incisions. There was still a convergence of five degrees.

R. O. RYCHENER,  
Secretary.

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## SUBJECTIVE SKIASCOPY

The pencil of rays admitted to the eye through the pupil, becomes a cone by the action of the refracting media, with its apex at the point where the rays are focused. At that point the rays cross and reverse their relations. Rays entering the upper half of the pupil pass at that point to the lower half of the cone; those entering the right half pass to the left, and vice versa. In Scheiner's experiment, described in 1619, light is admitted through two pin holes, one before each half of the pupil; causing a distinct point of light to appear single when the focus is on the retina, but double when in front of the retina (myopia), or back of the retina (hyperopia).

The relative position of these points indicates whether the eye is myopic (apparent upper point seen through upper hole), or hyperopic (apparent upper point seen through lower hole); their impressions being on the lower or upper part of the retina, and reversed

by projection into outer space. On the principle demonstrated by Scheiner's experiment, Porterfield (1747) gave a method of determining the point for which the eye was accommodated which was used and improved by Thomas Young (1801). Helmholtz (1856) suggested holding a needle before the eye. It appears single at the point for which the eye is focused, but double when nearer, or farther from the eye.

Recently other methods have been suggested for measuring the refraction, subjectively, by tests based on this principle. By Van den Bergh (1903) a narrow triangle was used. To measure the ametropia in any one meridian, its narrow angle was turned perpendicular to the meridian it was desired to measure. Covering the center of his pupil with a stylet, such as a Bowman probe, Van den Bergh could detect uncorrected ametropia of 0.25 D. in his own eye. But he had to use a stylet almost as broad as his pupil, and hold it very

accurately across the middle of the pupil. The name "subjective skiascopy" was suggested for this test.

Holth (1913) used a disc with pinhole opening in front of the pupil, while a distant point of light was looked at. If the eye is corrected the light appears steady. If there is uncorrected ametropia the light seems to move; with or against the pinhole, according, as the eye is myopic, or hyperopic; the amount of movement being proportioned to the amount of ametropia. This test was called "kinescopy". It was subsequently modified by holding a needle before the pupil, moving it and watching the movement of its shadow. From the Greek word meaning needle Trantas (1921) called his form of the test "velonoscopy", velonoskiascopy, or autoscopy. He followed Holth in using the motion of the needle before the eye, to test the correction or show remaining ametropia.

The latest modification of this test, Professor Lindner, of Vienna calls the "streifenprobe", streak test. He uses white lines on a red background, as suggested by Schwartz; and a wire cross held before the pupil instead of a needle. The lines of the chart can be adjusted, or the wires of the cross held at any meridian, and the expert observer can notice the effect of 0.25 D., or 0.12 D., of uncorrected astigmatism. Pascal, a pupil of Lindner, has modified this by use of a convex lens to render the eye myopic for testing at convenient distances, with the application of but a few lenses. He calls it "modified skiascopy". But he says "The method is too cumbersome for ordinary work, though it can be simplified by bringing the chart towards the patient, instead of having the patient walk up towards the chart". Lindner recommends his streak test "solely as a check test", and Pascal concludes, "In general, however, it may be said that in practice a subjective test with the familiar Snellen letters takes, in most cases, less time than a test by velonoskiascopy. So that velonoskiascopy is not recommended as a substitute test, to replace the present subjective tests. It is, however, espe-

cially recommended as an alternative test, where a patient has already been examined once or twice by the usual subjective methods."

Apart from the necessity of teaching each patient, what he is to observe and report upon, no subjective test tells what part of the pupil is corrected by the lens chosen. It may represent the choice of a lens that suits only a peripheral part of the pupil, that will be shut off when the patient uses his eyes. On this account it is inferior to skiascopy and the cross cylinder. Objective skiascopy shows exactly what part of the pupil is corrected. The cross cylinder gives the correction that is best, with the whole pupil participating in the finding. Apart from their occasional use in rare cases, to confirm the findings of other tests more commonly employed, the study and trial on one's own eyes, of the various methods of subjective skiascopy is an excellent way to gain a more clear and exact acquaintance with the mathematical basis of errors of refraction and their correction. For that reason it is a profitable thing upon which to expend time and effort.

*Edward Jackson.*

### LABORATORY DIAGNOSIS OF SYPHILIS

It is unfortunately true that the laboratory tests for syphilis are often least satisfactory in the cases in which we need them most, or, in other words, when clinical signs and symptoms cannot be depended upon.

This fact is of special importance to the ophthalmologist, since the most dangerous manifestations of syphilis in relation to the organ of vision, including those cases in which the eye surgeon is called upon to cooperate with the neurologist or internist, are likely to arise from invasion of the central nervous system or its coverings, and are therefore likely to present serious difficulties in diagnosis.

The popular impression that syphilis which breaks out on the skin is relatively free from danger agrees with the frequent experience that syphilitic pa-

tients who develop late complications are unable to recall earlier evidence of the disease, and hence are quite unaware that they have been infected.

It cannot be denied that since the discovery of salvarsan the general picture of syphilitic infection has been greatly modified, a more important part being played by late syphilitic disease of internal organs, for example of the aorta or of the central nervous system. In popular language, modern anti-syphilitic therapy causes the disease "to strike inward".

Many physicians are still too ready to accept the verdict of a blood Wassermann test with regard to the presence or absence of lues. Yet in the later and deeper complications a negative blood Wassermann is altogether unreliable, and it is necessary to resort to investigation of the cerebrospinal fluid. Lange (*Zeitschrift für Augenheilkunde*, 1931, volume 76, page 1), whose own work in the diagnosis of syphilis is well known, points out that much more important advances in refinement of diagnosis have been accomplished as to the spinal fluid than in regard to the blood test.

In the earlier studies of spinal fluid as to the presence or absence of syphilis, positive results were almost limited to cases of paresis. The spinal fluid Wassermann was negative in a large proportion of all cases of tabes, although it is now clearly understood that a definite diagnosis of tabes dorsalis carries with it a definite diagnosis of syphilis. The need for more precise diagnosis in regard to neurolues furnished the stimulus to refinement in technique.

Lange discusses the effectiveness of spinal fluid diagnosis along five lines of investigation, namely the Wassermann reaction, the Nonne-Apelt globulin reaction, the cell count, the Lange gold test, and exact quantitative estimation of total albumen in the spinal fluid.

The Wassermann reaction is specific, but is the least sensitive of all the tests. The globulin reaction and the cell count are not specific. At least as regards the normal condition of the

spinal fluid or the earliest departures from the normal, exact quantitative estimation of albumen is infinitely superior to the cell count.

The total albumen content of normal cerebrospinal fluid is stated as 20 mg. per 100 cc., within very narrow variations. With accurate technique, Lange is convinced that even a reading of 22 mg. is suggestive of a pathological increase, and that a reading of 24 to 25 mg. indicates an absolutely definite increase above normal.

Various authors have reported the cell count in normal cerebrospinal fluid as from none to ten or twelve cells per cubic millimeter. Thus the cell count cannot compete for exactitude with estimation of total albumen. The globulin reaction has, according to Lange, no great value, since it does not begin to be positive until the total albumen has increased to 45 or 50 mg. per 100 cc.

Unfortunately, the Wassermann reaction in the spinal fluid does not begin to be positive until the total albumen has increased to about 70 mg. Thus the Wassermann reaction, in spite of its specificity, is by far the least sensitive of all the reactions in spinal fluid diagnosis, and is worthless so far as a diagnosis of normal is concerned.

The gold reaction gives a positive result with even the smallest increase in total albumen, so that this test is superior to the cell count, globulin, and Wassermann tests as to sensitivity and precision. A negative gold reaction therefore justifies a diagnosis of normal spinal fluid and excludesluetice disturbance of the central nervous system. But for a normal diagnosis the estimation of total albumen has now become more important even than the gold reaction. It must be remembered, however, that all sensitive methods are also sensitive as to liability to error from faulty technique.

The delicacy and value of the gold reaction depend upon the fact that the cerebrospinal fluid contains only a trace of albumen, in very constant amount. Spinal fluid diagnosis demonstrates, not syphilis of the central nervous system, but syphilis of the meninges, and



as a general principle it may be stated that every form of luetic disease of the central nervous system, including tabes and affections of the eye and ear, takes origin from the meninges.

W. H. Crisp.

### THE VALUATION OF THE BLOOD PRESSURE IN THE RETINAL VESSELS AND ITS CLINICAL IMPORTANCE

Since Bailliart in 1917 devised his instrument; the ophthalmodynamometer, and since the publication of his book "La circulation retiniénne a l'état normal et pathologique" in 1923, a growing number of observers has been using his instrument and has considerably enlarged its sphere of application.

Recently Terson has suggested the name of *Tonoscopy* for this new method of measuring the blood pressure in the retinal vessels, and although some authors as Magitot and others, have accepted it, the present writer is not in favor of a designation which he considers misleading and lacking in accuracy.

We do not "see the tonus" of the eye as the term implies. We see the provoked pulse in the retinal vessels brought about by an artificial increase in the ocular pressure. As *tonometry* is the accepted designation for the measure of the ocular tonus "tonoscopy" evokes the idea of a method of seeing the ocular tension. A better name for Bailliart's method of observing the pulsation of the retinal vessels would be *sphygmascopy*, and the instrument to accomplish this end would be a retinal *sphygmoscope*.

The first, and to date the most important application of the syhygmoscopic method, is the detection of hypertension in the retinal arteries as a sign of increased intracranial pressure; especially in cases where the examination of the fundus is negative and choked disc has not yet or may never appear. When the neurologist sends a patient to the ophthalmologist for the

detection of ocular symptoms indicative of intracranial hypertension, he expects a great deal from this examination, on account of the very close physiological relations between the circulation in the vessels of the brain and those in the retina.

Disturbances in the brain circulation, probably a stasis in the venous sinuses and a corresponding anemia in the arteries, are the immediate results of an increase in the pressure of the cerebrospinal fluid. Although this increase may also cause papilledema, a symptom which has a great diagnostic value, there are from 46 percent to 60 percent of cases of brain tumors in which papilledema does not occur. In these cases the ophthalmologist and the neurologist are both handicapped in the diagnosis of intracranial hypertension. The discovery of a method of determining through the disturbance of circulation in the ophthalmic artery, the corresponding disturbance in the circulation of the vessels of the brain, is an important step toward the solution of this diagnostic problem.

Bailliart's dynamometer is a small, handy, instrument, the technique of application of which is easy to master. After putting some drops of holocaine in the eye, the tip of the shaft is applied upon the sclera behind the insertion of the external rectus and gradually pressed against the globe. A pointer shows upon a graduated disc the amount of this pressure in grams, and another pointer, remaining stationary, automatically registers the pressure made. It requires only a little training to observe the appearance, first of the minimum or diastolic pulse on the large arteries and then the systolic pulse, when the compressed arteries blanche and their walls collapse. Before using the dynamometer it is necessary to determine: 1st, the systemic blood pressure, 2nd, the intraocular pressure. The latter should be added to the pressure made with the dynamometer to obtain the whole amount of compression suffered by the retinal vessels. But as the dynamometer gives figures in grams these need to be transformed into mil-

limeters of mercury. To avoid calculations Magitot and Bailliart have made experiments in cats and computed tables which give the equivalent in mm. Hg. of any given dynamometer finding.

The average values found by these observers are 35 to 45 mm. for the diastolic pressure and 70 mm. to 90 mm. for the systolic. The venous pulse, which sometimes exists spontaneously in normal eyes, is usually a little higher than the intraocular pressure. Magitot has recently advised taking, instead of the diastolic, the medium retinal pressure, which is the one reached after the first oscillatory or vibratory movement of the artery has passed, and the artery pulsates steadily. This is easier to observe and can be compared to the medium general blood pressure, as obtained by the method of oscillations (Pachon instrument).

Comparing the retinal blood pressure with the one in the brachial or tibial arteries, the average found is 0.45 to 1.00, or about 1 to 2; half of the general diastolic pressure for the minimum retinal pressure. In cases of intracranial hypertension there is a marked increase of the diastolic retinal pressure which rises to 60 or even 80 mm. while the systolic pressure, although higher, rarely passes 110-120 mm. Following Bailliart, numerous observers, Bollack, Hartman, C. Berens, Smith Cornwell, Kalt and lately Magitot and E. Luque, have confirmed these facts in a great number of cases and assert that when the diastolic retinal pressure is higher by 10 or 15 mm. than half of the amount of the diastolic pressure in the brachial artery (this being normal) an intracranial hypertension exists. Retinal hypertension is an early symptom and may precede the onset of papilledema for a long time. Lumbar puncture or hypodermic injections of a hypertonic solution (Gaudissart) which bring about a decrease of the spinal fluid pressure, produce at the same time a decrease in the retinal diastolic pressure. Claude, Lamache, and Dubar, using injections of hypertonic glucose serum of 40 percent obtained in one case a decrease of the spinal pressure

from 44 to 36 mm. while the retinal diastolic pressure came down from 60 to 50 mm. On the other hand adrenalin injections increase both the general and the retinal pressures without changing the caliber of the central artery. But when an injection of acetylcholine chlorhydrate is made at the same time the artery dilates (Villaret, Shiff). Usually when papilledema appears the pressure in the retinal vessels immediately comes down to normal.

Besides this important clinical application new researches are being made in other fields, Espildora Luque (Chile) in a series of articles (*Arch. de Oft. Hisp.-Amer.*, August, October, December, 1931) divides retinal hypertension according to its etiology into three groups: 1st, hypertension due to an increase in the intracranial pressure from meningo-encephalic conditions and brain tumors; 2nd, retinal hypertension due to local ocular causes; glaucoma, arterio-sclerosis of retinal vessels, detachment of the retina and retrobulbar neuritis of rhinological origin; 3rd, retinal hypertension of vascular cause. The last he subdivides into: (a) that associated with systemic hypertension, (b) a local, solitary retinal hypertension with normal general blood pressure.

In the second or ocular group the rising of the blood pressure in the retinal vessels has a local diagnostic importance. In glaucoma it is probably a defense mechanism by which the increase of intraocular tension is overcome. When the pressure inside the eye starts to rise and reaches the level of the venous pressure in the retina a venous pulse appears (if it was not normally present before); then the increase in the tension continuing the retinal diastolic pressure is equaled and an arterial pulse will become visible. The finding of this arterial pulse in glaucoma means therefore, that the minimum retinal pressure is nearly equal to the intraocular tension. If the glaucomatous pressure still increases, the systolic pressure will also increase to counteract it and make possible the nutrition of the eye. This happens in

cases of normal general blood pressure, but if there is already a general hypertension the eye will probably benefit by it.

Recent researches made by Rollet, Sargon, Colrat, and others have shown that in some patients with retrobulbar neuritis due to nasal diseases, where a papillitis is rarely present, there is very often a retinal hypertension in the diseased eye. If a nasal operation is made, the visual disturbance may improve and in this case the retinal hypertension also diminishes or disappears altogether. The etiology of this vascular symptom is unknown. It is probably due to a vasomotor reflex action on the retinal vessels. Luque describes a case of occlusion of the central artery in one eye, the other having a normal retinal pressure. This suggested an embolism being the cause of the occlusion, as otherwise if a spasm or a thrombus due to endarteritis obliterans had been present, probably the retinal pressure in the good eye would have been elevated. A general examination proved this assumption to be correct, as the blood pressure was normal and there was a mitral stenosis.

In the third group when there is a general hypertension the retinal pressure may also be increased, especially if there are also vascular lesions in the retina associated with renal retinitis, retinitis of pregnancy, thrombosis of the central vein, and so forth.

E. Luque describes as a new pathological entity cases of retinal local, solitary, hypertension, with normal fundus and normal general blood pressure. He claims that there is here a peculiarity in the character of the retinal hypertension which separates it from the others. The systolic readings are so high that they are usually near to the 150 mm. limit or beyond so that they can not even be measured. The functional symptom consists in headache often severe, usually occipital and nocturnal, and reaching in some patients the intensity of an attack of ophthalmic migraine. There are also tinnitus, dizziness, amnesia and rarely epistaxis. The visual symptoms are *muscae volitantes*, sparks, luminous balls and blurring of vision, going in exceptional cases to temporary blindness. In some patients the visual symptoms and in others the vertigo and headaches predominate. The author believes that these are the result of a local hypertension in the territory of the internal carotid which may be associated with general hypertension, but frequently is isolated. The severity of the symptoms of retinal hypertension is out of proportion to those of the general condition.

In support of his ideas the author reports the history of ten patients. In several the spinal fluid pressure was found normal. On the other hand the disproportion between the general blood pressure, and the retinal pressure, was enormous.

These findings of Luque, if confirmed by other observers, point to the importance of taking the retinal blood pressure in suspected patients, even when there are not fundus changes or systemic hypertension.

Thus an increased knowledge of the physiopathology of retinal circulation and an accurate clinical measure of both retinal pressures compared with the general blood pressure, has made possible the early diagnosis of some conditions and given a better interpretation of special symptoms in others. The road is only opened and new research work is necessary to confirm these views and clear the way for new developments in this promising field.

*Manuel Uribe Troncoso.*

#### THE TUBERCLE BACILLUS IN UVEITIS

A very interesting pamphlet has recently been sent by Professor J. Meller to his former pupils. This reprint contains two lectures which Professor Meller gave, the first on November 4, 1931, before the American Medical Association of Vienna and the second on January 18, 1932, before the Ophthalmological Society of Vienna. The substance of the first lecture was the rôle of the tubercle bacillus in the produc-

tion of chronic uveitis. The fact of the inability ever to find this organism in the tissue, in spite of an appearance frequently quite typical of tuberculosis elsewhere in the body, was stressed. Ophthalmologists had argued that because the characteristic tubercular nodules were not found the lesion was not tuberculous, having overlooked the well known fact that tuberculous lesions vary greatly in appearance depending on the particular tissue involved as well as on its power of defense against the invading organisms.

Another point frequently made against tubercular origin of uveitis has been the absence or supposed absence of active lesions elsewhere in the body, but it is practically impossible to exclude the presence of a minute active focus and even a very tiny one is sufficient to permit dissemination of the organisms into the blood stream.

The successful isolation of tubercle bacilli from the blood, by Löwenstein, in a large percentage of cases of known tuberculosis seemed to the author to be extremely suggestive of the fact that these lesions, in spite of the negative findings of the organisms in the ocular tissues, were undoubtedly tubercular. The final link in the chain of evidence would be the actual growing of the organism from an acutely, or subacutely, inflamed eye.

The second lecture contained the report of the actual growing of organisms in one case of typical chronic uveitis, by Dr. Löwenstein. The case, which is presented in great detail, was also used to illustrate two very different ways in which tuberculosis could affect the two eyes of the same individual.

The failure to detect tubercle bacilli in the lesions of chronic uveitis was attributed to the fact that the reaction in the eye was different from the reaction elsewhere in the body and the probability that the epithelioid cells devoured the organisms in a short while and that it was only during the very brief period before this had taken place that the organisms might be stained.

That the cultivation of the tubercle

bacillus from an endogenously affected eye is of cardinal importance when coming from such a distinguished worker as Dr. Löwenstein needs no further elaboration. Chronic uveitis has been a puzzle to ophthalmologists since it was first recognized, both as to etiology and treatment. In Europe the tendency has been to regard it as tubercular while in America it has usually been thought to be due to focal infections, some believing it due to toxins and others to the organisms themselves. To have conclusive proof that certain uveitides are due to the lodgement of the tubercle bacillus in the eye will help to clarify the situation. However it is obvious that the possibility of error in one case is too great for this most interesting finding to be accepted without further corroboration. Fortunately this work is capable of reproduction and if similar results are found by others, an extremely important advance will have been made and great credit will be due to Dr. Löwenstein for his contribution.

*Lawrence T. Post.*

## BOOK NOTICES

**Madras Government Ophthalmic Hospital Report for 1931.** Lieut.-Col. R. E. Wright, M.D. Paper covers, 44 pages, illustrated. Price 1 rupee 6 annas. Madras Government Press, 1932.

The most important mass of surgical work done in this institution is naturally in cataract extraction. Preliminary capsulotomy has been continuously practiced for the past century, and is warmly defended by Colonel Wright, superintendent of the hospital, especially for dealing with complicated cases. For the past three years he has been resorting to a large tongue-shaped flap in the capsule, executed with the knife at the time of making the corneal section. This flap is subsequently torn off at its hinge with a suitable forceps, either before or after delivery of the nucleus.

Since the Madras hospital has been for years a teaching center—perhaps



the largest postgraduate ophthalmic teaching center in the Far East—the tendency has always been toward developing and teaching simple “safety-first” methods. Colonel Wright offers a number of interesting comments on the Smith and Barraquer methods, and also on the intracapsular technique now very commonly known under the name of Stanculeanu or Knapp.

In the operative treatment of glaucoma, sclerocorneal trephining has usually been employed.

Many interesting cases of types not usually seen in Europe or the United States are described, and careful statistics of the very large amount of material dealt with in this famous hospital are appended.

*W. H. Crisp.*

**The Retinal Processes Concerned with Visual Acuity and Color Vision.** By Selig Hecht. Bulletin No. 4, Howe Laboratory of Ophthalmology, 87 pages. Harvard University Press, Cambridge, Mass., 1931.

The author's thesis concerning the increase of visual acuity with the intensity of light is quite simple. The retinal cones either react fully or not at all, but they vary widely in their sensitivity, according to a law of distribution similar to that of errors, or of attributes in biological populations. Therefore, while the cones are all excited at very high intensity, only a diminishing fraction react as the intensity is lowered; so that vision then has to do, in effect, with a correspondingly coarser pavement of functioning end-organs. Hence the reduced acuity. The early and complete data of König are analysed according to this view. To this the author adds the results of ingenious work of his own, on the visual acuity of honeybees. The insect's eye, quite different in its structure and optics from the human, he finds to conform to a similar law, with quantitative differences, of course.

The larger part of this work concerns color vision. The classic color theory of Young and Helmholtz, and its experimental working-out by Ab-

ney and König, will recall the three curves which represent the responses of the red, green, and violet primary processes to the various parts of the spectrum. It has always been admitted that the valences assigned the primary colors do not agree at all with the luminosity of the spectrum. The author makes the attempt to redraw these curves in harmony with *all* the facts of color vision, such as the luminosity and saturation of the spectral lights, and sensitivity to wavelength difference. The surprising result he advances tentatively. As usual, his work provokes thought. A bibliography of one hundred titles is appended.

*Percy W. Cobb.*

**Section on Ophthalmology American Medical Association, Transactions of 1931. meeting at Philadelphia.** Cloth 460 pages, illustrated. Chicago, American Medical Association, 1931.

A volume of transactions is not the medium for the earliest publication of a paper; but it is the most convenient plan for subsequent reference. The Section of Ophthalmology, with its pre-session volume calling attention to the papers before they are read, gives the best possible substitute for early publication; and makes its Transactions, which include the discussions on the papers, one of the most valuable series that can be found in any library dealing with ophthalmology. Even the Journal of the American Medical Association omits enough of the papers that appear in the Transactions to be annoying to the ophthalmologist, although it may give everything of interest to the general practitioner.

Even papers that contain very little worth reading sometimes become valuable through the discussions they excite.

This makes forty volumes that have been issued in this series; a larger number than have been published by any other national ophthalmological society, except that of Great Britain and that of Germany. The American

Ophthalmological Society was organized earlier, but for many years published its Transactions in parts, of which two to four were included in a single volume. In harmony with this seniority, it has of late years been impossible to get certain of the earlier volumes of the Section Transactions. This should be borne in mind, with a hope of accidental discovery of stray copies, that may still be in existence.

This volume also contains the list of fellows of the American Medical Association, who have registered in the Section during the last four years. Among the illustrations are color plates, one of a case of choroideremia, and two of a case of megalophthalmus. There is also a series of intended stereoscopic photographs of the anomalies of the fundus. Like most such photographs that are printed on the pages of books and journals the two images are so wide apart that very few people can get the stereoscopic effect by looking at the pages.

This volume contains twenty-four communications, in addition to reports of Committees and accounts of interesting apparatus. It also has a good index, that essential for a convenient reference book.

*Edward Jackson.*

**The experimental study of reading.** By M. D. Vernon. 190 pages, 15 illustrations. Price \$3.00. Cambridge at the University Press, 1931.

This work is published upon the basis of a grant made by the Medical Research Council of Great Britain. It is in the main a very skillful compilation or digest of the experimental work done by

a number of investigators in different laboratories of the world, with regard to the psychology of reading. A careful bibliography at the end of the volume includes 159 references.

The final chapter contains an interesting series of conclusions, a few of which may be mentioned here. The voluntary and reflex movements about the field of vision were primarily inaccurate and erratic, and this behavior continues to a greater or less degree in the reading of the young child. But in mature adult reading, a series of regular and rhythmical backward and forward movements has developed, which can be applied not only to the normal reading of English, but also in reading foreign languages, disconnected words, algebraic and chemical formulæ, and figures arranged in horizontal or vertical lines. Once reading has become fully matured, details in the objective stimulus such as the size and nature of the printing type are usually ignored, the perceptual processes being so readily supplemented on the general trend of associated thought that a mere skeleton of the normal perceptual structure can be successfully assimilated.

Special subjects considered throughout the volume include photographic recording, convergent and divergent movements; torsional movements; spatial perception; perception of rate of movement; variations with age and maturity of reader, in silent and oral reading, with the purpose of the reading, with the nature of the reading material, and with motor habits; visual perception; and typographical factors.

*W. H. Crisp.*

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history

### 1. GENERAL METHODS OF DIAGNOSIS

Bedell, A. J. **Some anomalies of the fundus: Stereoscopic photographic demonstration.** Jour. Amer. Med. Assoc., 1932, v. 98, Feb. 6, p. 449. (Abbreviated from the complete article published in the Trans. of the Sec. on Ophth. of the Amer. Med. Assoc., 1931, p. 303.)

Attention is called to the great number of developmental changes found in the fundus. After a consideration of the variations in the size and surface of the disc, colloid bodies are illustrated with sufficient clinical description to assist any ophthalmoscopist to make a correct diagnosis. The epipapillary membranes are described under three classes: ragged masses, glistening membranes, and persistent hyaloid tubes. By structure and location all of these are proved to represent incomplete absorption of embryonic tissue.

Reference is made to the vascularization of the fundus, and some types of vessel distribution are illustrated. The colobomas are photographed to show the structures involved in the defects and also to demonstrate the distinction between inflammatory reactions and congenital malformations.

The author concludes that the ophthalmologist must be familiar with the anomalies here discussed: Epipapillary

membranes are often confused with inflammatory tissue. Hyalin or colloid bodies in the disc simulate a swelling of the optic nerve. Isolated medullated nerve fibers may be misinterpreted as exudate. Ectasia of the optic nerve sheath may be incorrectly diagnosed as glaucoma or, if especially white, optic atrophy. Congenital defects of the choroid and optic nerve are mistaken for areas of acquired choroidal atrophy. (Ten figures.) *George H. Stine.*

Ferree, C. E., and Rand, G. **Ways in which distance of the test field affects determinations of retinal sensitivity.** Arch. of Ophth., 1932, v. 7, March, pp. 383-388.

The size of the image may be kept the same by varying the size of the object with the distance, but the change of accommodation at varying distances produces changes in the second nodal point of the eye which result in further changes or variations in the size of the image. The size of the pupil changes with accommodation, and the flux of light through the pupil varies as the square of the pupillary diameter.

*M. H. Post.*

Harman, N. B. **An electric ophthalmoscope.** Brit. Jour. Ophth., 1932, v. 16, Feb., p. 102.

This is a reflecting ophthalmoscope

with a battery handle, 15 lenses, and a range of 70 diopters from +30 to -39 in steps of 1 diopter. The range of 70 diopters is produced by means of two lens discs which overlap at the sight hole. The larger disc has ten holes, one blank and nine with lenses from -1 to -9. The smaller disc has seven holes, one blank, the others with lenses +10, +20, +30, -30, -20, -10. By proper manipulation of these discs a lens of any desired strength can be brought before the sight hole. The instrument is compact and easily operated. (One illustration.)

*D. F. Harbridge.*

## 2. THERAPEUTICS AND OPERATIONS

Corrado, A. **Notes on local iodine therapy in ocular diseases.** *Lettura Oftalmologica*, 1931, Feb., p. 82.

Reference is made to the good results obtained from the use of a pomade of iodol in ulcerative and squamous blepharitis, and in conjunctivitis and progressive septic corneal ulcers, particularly of the hypopyon type. Its use is considered beneficial as a prophylactic in traumatic and postoperative cases. The formula used by the author is: iodol 0.30, lanolin 6.0, ophthalmic vaseline 24.0. It is used in the conjunctival sac or externally and has no irritating effect.

*F. M. Crage.*

Duschnitz, K. **Calcium treatment of eye diseases.** *Klin. M. f. Augenh.*, 1932, v. 88, Feb., p. 227.

Duschnitz reports on his experiences with the treatment of two hundred eye patients, within seven years, with calcium chloride 15 parts to 180 of water, a teaspoonful three times a day, and with intramuscular injection of a ten percent solution of calcium "Sandoz". He had excellent results in all kinds of scrofulous affections, good results in iritis, iridocyclitis, and cyclitis of scrofulous or tuberculous origin, and sometimes also in rheumatic cases. In all other types calcium had at the most an anodyne effect, and none at all in episcleritis and trachoma.

*C. Zimmermann.*

Erlanger, Gustav and Alice. **Localized dilatation of the pupil from iontophoresis with adrenalin.** *Klin. M. f. Augenh.*, 1932, v. 88, Jan., p. 86.

By introducing adrenalin 1:1000 with iontophoresis (galvanic current of one milliampere for one minute), into the eyes of rabbits and man, the authors produced localized dilatation of the pupil of long duration. After preliminary iontophoresis with calcium, adrenalin 1:10,000 was effectual. Important therapeutic results are possible with this method.

*C. Zimmermann.*

Glees, Matthias. **On the action of pantocaine on the eye.** *Klin. M. f. Augenh.*, 1931, v. 87, Dec., p. 755.

Pantocaine is a derivative of novocaine, easily soluble in water, and can be boiled for hours without damage. One or two drops of a one or two percent solution are sufficient for local anesthesia in the eye. On account of its rapid action it is especially recommended for office practice and tonometry.

*C. Zimmermann.*

Kleefeld. **New applications of retrobulbar injection.** *Bull. Soc. Belge d'Ophth.*, 1931, no. 62, p. 24.

The writer considers the 3.5 cm. dental needle decidedly the best for these injections because of its flexibility and fine caliber. He describes as of inestimable value the discovery by Weekers of the effect of injections of 40% alcohol, by which it is possible to suppress pain in the course of an ocular affection without unfavorable influence on the course of the disease and without causing neuroparalytic keratitis. The muscle paralysis following these injections may last several weeks but eventually always disappears completely. These injections are made in the neighborhood of the ciliary ganglion, whereas injection of alcohol into the Gasserian ganglion causes a considerable number of cases (seventeen to thirty percent) of neuroparalytic keratitis. In 1930 Weekers published his first experiments in the retrobulbar injection of dionin. This with adrenalin causes a rapid drop in the ocular tension. The author has ap-



plied the dionin-adrenalin method to induce rapid hypotony in a case of recent embolism of the central artery of the retina. The attempt was unsuccessful, and later examination demonstrated a complicating partial thrombosis of the central vein. In two cases injection of novocaine-adrenalin promptly relieved severe retrobulbar, frontal, and temporal neuralgic pains. For more lasting effects one may follow the injection of 1 c.c. of two percent novocaine with 1 c.c. of 40% alcohol. Further applications of retrobulbar anesthesia mentioned include that of Van Lint in cataract extraction and the examination and didactic demonstration of painful or extremely photophobic eyes.

*J. B. Thomas.*

**Luzsa, Endre. Treatment of eye diseases with sodium hydrocarbonate.** Klin. M. f. Augenh., 1931, v. 87, Dec., p. 769.

In conjunctival affections Pellathy and Schneider employed sodium hydrocarbonate (Klin. M. f. Augenh., vol. 85, p. 774) for converting the pathological acid reaction of the diseased tissue into a normal reaction, and they reported therapeutic results. Luzsa's observations, however, show that the drug has no therapeutic effect and causes a disagreeable burning. *C. Zimmermann.*

**Nyulassy, S. Disinfection before intrabulbar operations.** Oft. Sbornik, 1931, v. 6, pp. 92-94.

The author stresses the necessity of thorough disinfection prior to operation. He tested the bactericidal qualities of Betti's ointment (combination of one percent optochin and two percent precipitate mercury) and argolaval (combination of silver nitrate and urotropin) on serum agar cultures of bacteria common in eye infections. Betti's ointment is fifty percent more germicidal. Clinically, Betti's ointment is very irritating, causing marked edema and even eczematike conditions. Argolaval is well-borne and the conjunctiva is only slightly irritated and always negative on culture after the third instillation. Although Betti's ointment is a more

efficient germicide he feels that argolaval produces sufficient conjunctival disinfection. (Bibliography.)

*G. D. Theobald.*

**Oppenheimer, E. H. Needle cautery.** Klin. M. f. Augenh., 1931, v. 87, Dec., p. 804. (III.)

Oppenheimer has devised and illustrates a needle cautery, whose one rod terminates in a platinum needle of 4 mm. Its point becomes glowing red after two or three seconds. It is manufactured by Wurach, Berlin.

*C. Zimmermann.*

**Simko, S. Avertin in ophthalmology.** Oft. Sbornik, 1931, v. 6, pp. 110-112.

Avertin (tribromethylalcohol, for rectal anesthesia) was used in twenty-one children aged one to eleven years, in conjunction with local anesthesia, for various eye operations (extraction of traumatic and juvenile cataracts, iridectomy, enucleation, and so on). Children wake in three to six hours without any untoward symptoms. If all precautions are observed for its application, there is no danger. If the length of narcosis could be timed and if there were a known antidote, this would be an ideal anesthetic: 0.15 gr. per kilogram of body weight produces satisfactory narcosis. *G. D. Theobald.*

**Wiesle, Paul. Percaine as an anesthetic in ophthalmology.** Zeit. f. Augenh., 1932, v. 76, Jan., p. 157.

Percaine is alpha-butyloxycinchonic-acid-diethylethylendiamid. It is a local anesthetic which is marketed in ampoules of 1 to 1000 solution with twenty drops of adrenalin solution added to each 100 c.c. Its action is more lasting than that of cocaine. It has no deleterious effect on the corneal epithelium and does not cause dilatation of the pupil. Injection of 0.5 mg. produces adequate anesthesia for extirpation of chalazia. Such operations are usually followed by somewhat more copious hemorrhage than after cocaine.

*F. Herbert Haessler.*

Woodruff, H. W. **Intraocular hemorrhage following operations on the globe.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1931, p. 276.

Five cases, including four of cataract and one of glaucoma, showed extensive disease of the choroid and retina. Also there was marked sclerosis of both arteries and veins, with areas of round-cell infiltration.

The important etiologic factors in the production of cataract and glaucoma may also be predisposing factors in the occurrence of the type of hemorrhage under consideration. Degenerative vascular changes accompany advancing age. Furthermore, the presence of toxic conditions, or of syphilis, nephritis, or alcoholism, with their predilection for the vessels, causes either primary or secondary endarteritis and vascular sclerosis.

It is not at all surprising, then, that some of the less violent forms of intraocular hemorrhage occur in four or five percent of cases operated upon for cataract and glaucoma, and occasionally when the larger vessels are affected, such as the long posterior ciliary arteries, an expulsive hemorrhage occurs (from 0.01 to 2 percent). The factor, then, of first importance is thorough physical examination, not omitting a blood Wassermann test and chemical examination of the blood, followed by the indicated preoperative treatment, such as reduction of blood pressure by the various procedures suggested, perhaps the administration of calcium. Reduction of ocular tension in glaucoma by miotics and, when these fail, by intravenous salt injections is important.

While hemorrhage has occurred in all types of cataract extraction the method by capsulotomy would probably be considered somewhat safer. Certainly slow evacuation of the aqueous, and, if pain is complained of, delay in completing the operation is advisable. While hemorrhage has also occurred in all types of glaucoma operation, the author thinks it less apt to occur in the operation of iridotaxis, the incision being made under a conjuncti-

val flap with the keratome. Sutures also help to prevent late hemorrhage. In extraction the preformed flap (the Van Lint flap) is of value. Considerable bleeding from the conjunctival flap is to be encouraged. When the flap is sutured in position over the corneoscleral incision, it acts as a splint, preventing reopening of the wound.

If during the operation expulsive hemorrhage occurs, a bandage should be applied at once and the head raised and morphine given for the pain. The eye should not be removed at once, as some apparently hopeless cases have been saved by removal of the clot and suturing the flap. (Nine figures. Discussion.)

*George H. Stine.*

### 3. PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Blatt, Nicholas. **The correction of high myopia by Mueller's contact glasses.** Arch. of Ophth., 1932, v. 7, March, pp. 399-417.

The author has used Mueller's contact glasses in thirty-eight cases of high myopia. Most of these patients had an intellectual occupation, or did handicraft work. Twenty-four had astigmatism. There were seventeen females and twenty-one males, the youngest ten years of age, the eldest sixty-three. Myopia varied from ten to thirty diopters. Most of the patients had anisometropia and corneal scars; myopia and irregular astigmatism were frequently associated. The anisometropia was as high as fifteen diopters in one case. Twelve cases had changes in the fundi. The vision varied from perception of fingers at 0.5 meter to the same at two to three meters. Those cases showing corneal scars responded best of all. The author has found it difficult to persuade patients to purchase the glasses and wear them regularly. Only two of his patients have done so, although several have tolerated their glasses easily all day. One even sleeps with them. Disappearance of muscular insufficiency and dynamic divergence has been observed.

*M. H. Post.*

Bothman, Louis. **Homatropin and atropin cycloplegia: a comparative study.** Arch. of Ophth., 1932, v. 7, March, pp. 389-398.

As between refraction under homatropin and atropin cycloplegia, the author finds that while one-half diopter may be the average difference of result in hyperopic eyes, individual cases may show a difference greater than two diopters, and in cases of myopia or mixed astigmatism even greater differences may be demonstrated. The homatropin cases were treated with a solution of two percent homatropin hydrobromide instilled every ten minutes for fifty minutes, the refractive error being determined one hour after the last instillation. The atropinized eyes were treated by the use of atropin sulphate one percent for a period of four and a half days, fourteen drops in all being used. In adults, frequently first one eye was atropinized and examined and later the other. The author concludes that atropin, as the better cycloplegic, should be used more, especially in myopia, and that all cases which have good vision without correction but accept weak minus corrections under homatropin should be further examined with atropin.

*M. H. Post.*

Duane, Alexander. **Diplopia and other disorders of binocular projection.** Arch. of Ophth., 1932, v. 7, Feb., pp. 187-210.

This paper does not lend itself to abstraction, but contains an excellent, concise description of the various disorders accompanying diplopia and binocular projection, their causation and correction, both subjective and objective. A number of illustrative cases are recorded. The paper concludes with a discussion of suppression and incongruous diplopia. It well deserves study in full.

*M. H. Post.*

Gallerani, G. **The apparent phenomena in simultaneous contrast.** Ann. di Ottal., 1931, v. 59, Sept.-Oct., p. 804.

In looking directly at a group of crossed rectilinear lines at a distance of about thirty centimeters those at the

point of fixation will be perfectly black, while those peripherally situated will to the indirect vision have a grayish tone, the difference being more marked as the lines are thinner. The theory given in explanation of the phenomenon is as follows: In direct vision at the crossing of the lines, the light rays falling on the fovea are received by one or not more than two of the cones, articulating with one or not more than two elements of the granular layer which are continued through one ganglionic neuron. The rays striking peripherally, however, are transmitted by a larger number of ganglionic neurons as the distance is increased from the macula. The difference in apparent blackness at the center and toward the periphery is not due to the contrast of the black lines and the white spaces, which is also present at the fovea, but to the psychic fusion of the two simultaneously excited centers, that of the larger circle of the periphery and the smaller one of direct vision.

*Park Lewis.*

Haas, Etelka. **On Imbert's chromotometry as a method for determining refraction.** Graefe's Arch., 1931, v. 126, pt. 4, pp. 528-535.

Helmholtz realized that the eyes were not fully achromatic, but that the distance point for his eyes when sighting at a small orifice illuminated with spectral red was farther off than when the illumination was a violet light. His idea of using chromatic aberration for determining refraction has recently been realized by two workers. One of these, Imbert in France, working with Pech's ericiscope, obtained results that did not coincide with those of Helmholtz. His apparatus is a 20 cm. cubical box the front wall of which consists of half red, half blue glass. Behind this is a sheet of ground glass, and before the colored pane is a transparent glass having opaque letters, which are graded in size from about Snellen D=18 to D=5. The size of the object has no decisive value in determining refraction. A five candle power lamp is placed in the box. Imbert measured the wave lengths that were

transmitted through the apparatus and tested emmetropic, myopic, hypermetropic, and presbyopic eyes for chromatic aberration. He found that this might depend upon refraction, contrary to what had heretofore been assumed.

Haas's experiments were designed to answer the questions whether the difference in the power of refraction of an eye for long- and short-waved light depended upon the refractive error; whether it depended upon conditions of accommodation; and whether the values varied when numerous subjects were tested, in excess of what former investigators had found—especially if the values exceeded three diopters. The near and far points were tested in a number of people of different ages (18 to 44 years) using colored light. For far-point determination the usual methods of testing refraction were used; for near point, Scheiner's optometer. The results indicate that chromatic aberration of the human eye is not dependent upon accommodation, refraction, or age, and that it lies consistently between 1.5 and 2.5 diopters.

*E. S. Buss.*

Huber, O. **Diminution of refraction by trauma.** *Klin. M. f. Augenh.*, 1932, v. 88, Feb., p. 230. (See Section 16, Injuries.)

Kazdan, Louis. **The use of contact lenses for the optical correction of conical cornea.** *Canadian. Med. Assoc. Jour.*, 1931, v. 25, Dec., p. 663.

After giving a brief history of the development of the contact glass, the author describes the technique of its use. A simplified apparatus for inserting the lenses is described. Two cases are cited in which vision was improved by the use of contact lenses. *M. E. Marcove.*

Pascal, J. I. **The iosciascopy test.** *Arch. of Ophth.*, 1932, v. 7, March, pp. 378-382.

This recent subjective method for testing and measuring astigmatism was first presented at the International Congress of Ophthalmology at Amsterdam, by Raubitchek, who believes that it will ultimately supplant all other sub-

jective tests for astigmatism. The test consists of a revolving disc in a fixed frame. Surrounding this disc are two scales, the outer one calibrated for plus cylinders and the inner one for minus cylinders. On the outer scale zero is on the horizontal to the left; on the inner scale the zero mark is at the top of the vertical meridian. On the revolving disc is an arrow composed of two parabolic arcs set with their convexities toward each another, so that the final direction of each arc running at the base is at right angles to the original direction at the tip. When rotated to point in the axis of the astigmatism, both arcs become equal in intensity. An intricate plan, involving the use of a table of coordinates, is described for determining the amount of astigmatism present.

*M. H. Post.*

Strebel, J. **Qualitative and quantitative anorganic analyses of the emmetropic human eye.** *Klin. M. f. Augenh.*, 1931, v. 87, Dec., p. 747.

For ascertaining the resistance of the sclera, with regard to sclerectasia in myopia, the anatomo-histological investigation alone is not sufficient, and must be supplemented by chemical analysis, which Strebel undertook and describes in detail. He found no silicic acid and no potash, but abundant phosphoric acid, calcium, and magnesium. In a future article he will give a comparison of their quantitative values in emmetropic and myopic eyes, a discussion on the localization of calcium salt in the fibrillæ of the sclera, and clinical proofs on the relationship of calcium metabolism and progression of myopia, with chemotherapeutic points of view.

*C. Zimmermann.*

#### 4. OCULAR MOVEMENTS

Coppez, H. **Concerning a new case of congenital absence of lateral movements of one eye.** *Arch. d'Ophth.*, 1932, v. 49, Jan., p. 18.

Photographs of an eleven-year-old girl show clearly the absence of voluntary lateral rotation of the left eye. Rotation of this eye in a lateral direction with forceps was also found to be im-



possible. Thus the case belongs to that class of anomalies in which anatomical investigation has disclosed fibrosis of the external or internal rectus muscle, or the formation of fibrous bands associated with Tenon's capsule and preventing lateral rotation, and not in the class in which nuclear lesions are present. From a review of all cases described the preponderance of evidence is that these congenital defects in motility are usually due to local malformations producing mechanical interference with rotation rather than nuclear lesions with secondary alteration of function.

*M. F. Weymann.*

Whittington, T. H. **Ocular complications of chronic epidemic encephalitis.** Brit. Med. Jour., 1931, Nov. 28, p. 981.

In the acute stage, epidemic encephalitis presents varied symptoms which may simulate diseases of the brain. In a series of 1152 cases, 78 percent had the extraocular muscles affected in one way or another. Ptosis occurred in nearly 50 percent, squint in 34 percent, diplopia without obvious squint in 18 percent, and nystagmus in 18 percent. The presence of papilledema or of optic neuritis is against the diagnosis of encephalitis.

The ocular signs and symptoms so commonly present at the onset and in the acute stage of the disease are comparatively rare in the chronic stage. Ptosis is only infrequently present. A great many cases have diminished or absent pupillary reactions. Paralytic squint is usually absent but there are a large number with concomitant external strabismus or some other form of divergence. In the Parkinsonian form of this disease, oculogyric crises come on from one to eight years after the original acute illness. They consist of spasmodic conjugate movements of the eyes upward and usually to one side or the other, lasting from a minute to many hours. In the treatment of Parkinson's disease, heavy doses of stramonium are often continued indefinitely. Many patients complain of photophobia and inability to read, due to paresis of accommodation and dilatation of the

pupils. The addition of a plus 1.50 lens for reading and a miotic instilled into the conjunctival sac will relieve the patient of these symptoms.

*M. E. Marcove.*

Wiedersheim, O. **Mode of oscillation in miners' nystagmus.** Klin. M. f. Augenh., 1932, v. 88, Feb., p. 149. (Ill.)

The mode of oscillation can be easily photographed with the photonystagmograph by observation of the paths of the corneal reflex of a very fine light. While the simple forms of nystagmus represent a more passive motion (relaxation nystagmus), the complicated jerks are active reflex impulses (excitation nystagmus). The oscillation curves of nystagmus and tremor of the head and extremities show that the photonystagmograph is also useful for the study of other forms of tremor, demonstrating the parallelism of nystagmus and tremor of the extremities; and they speak for the author's assumption that miner's nystagmus is an antagonistic tremor like that of the extremities.

*C. Zimmermann.*

##### 5. CONJUNCTIVA

Baldanzellu, T. **The clinical relations of trachoma and tuberculosis.** Arch. di Ottal., 1931, v. 38, Dec., p. 621.

In one hundred cases of granular conjunctivitis of varying stages of activity in which careful histories were taken together with physical and radiological examinations, active pulmonary involvement, progressive infectious processes, tuberculous allergy, and toxic involvements were found. There were apical infiltrations with bronchoalveolitic foci, subapical sclerosis and calcification, engorgement and calcification of the peribronchial glands. Frequently in a lymphatic or scrofulous diathesis there was endocrinal imbalance. The skin reaction in a high percentage of cases was positive. It was noted that corneal complications occurred more commonly in lymphatic infants and children, while the cicatricial state was more frequent in adults. In the trachomatous, as in the phlyctenu-

lar, it was apparent that the clinical picture was that of the exudative diathesis superimposed on a tuberculous or paratuberculous basis. The author concludes that the local reactions of the trachomatous nodules and the papillary hypertrophies in the conjunctiva bear a close relationship to, if not identical with, toxico-infective tuberculous granules in their development, their cause, and their final results, modified only by the differences in location. (Bibliography.)

*Park Lewis.*

Baroni, V., and Michael, D. **Researches on the conservation of trachoma virus.** *Rev. Internat. du Trachôme*, 1932, v. 9, Jan., p. 30.

These authors have performed a number of experimental inoculations with trachoma virus on blind eyes. They conclude that the virus conserved in glycerin for periods of one hour, seven hours, and twenty-four hours respectively is capable of producing after an incubation period of from five to nine days an acute diffuse trachomatous infection. The virus conserved in the anterior chamber of the rabbit for periods of twelve, twenty-four, and forty-eight hours always remained inactive. The virus came inactivated when conserved in dog plasma for periods of 48 hours and six days. It was also inactive when conserved in human plasma at 6° C. for twenty-four, thirty, and fifty-two hours. It remained active when conserved in human plasma at 37° C. for twenty-four hours, but became inactive after six days. It was active when conserved in human serum, previously heated to 56° C., for one-half hour and then maintained at 21° C. for thirty hours in one case and three days in another. The authors suggest that in view of this last result it is possible that alexin may have some destructive action on the virus.

*Phillips Thygeson.*

Cattaneo, Donato. **Unilateral trachoma.** *Rev. Internat. du Trachôme*, 1932, v. 9, Jan., p. 1.

Among 1600 cases of trachoma treated by the author, sixteen presented only unilateral disease. However, on

examining these apparently normal eyes with the slit-lamp and corneal microscope, the author found changes which led him to believe that trachoma existed, although in a very light form. He suggests the majority of cases of so-called unilateral trachoma are of this type.

*Phillips Thygeson.*

Fehmi, Nuri. **Tuberculin therapy in trachoma.** *Rev. Internat. du Trachôme*, 1932, v. 9, Jan., p. 44.

Fehmi reports a case of rebellious trachoma with pannus in a boy aged fifteen years. The usual medications such as silver nitrate and copper sulphate failing to influence the disease, the author began treatment with tuberculin. In order better to observe the effect on the disease, he discontinued all other medication. After a period of three months the patient had improved remarkably in general condition, and the granulations had all but disappeared. The author believes that the tuberculin acts by reducing the lymphatism which Angelucci and others have described as playing a preponderant rôle in trachoma.

*Phillips Thygeson.*

François, Jules. **Syphilitic lymphomatosis of the conjunctiva.** *Arch. d'Opht.*, 1932, v. 49, Feb., p. 91.

An adult male first showed a diffuse tumor mass of the lower left cul-de-sac, which was diagnosed as benign lymphoma by biopsy. Because of some anal mucous plaques a Wassermann test was made which was found to be strongly positive. One month later a similar tumor appeared in the right eye. At this time treatment with salvarsan was begun which cured the anal condition and caused retrogression of the conjunctival tumors. After two months all traces of the conjunctival lymphomata had disappeared. As lymphomata do not tend to recede spontaneously, the conjunctival condition was considered as a syphilitic lymphomatosis. A brief review of other syphilitic affections of the conjunctiva is given.

*M. F. Weymann.*

Janawoska. **Trachoma and tuberculosis.** Rev. Internat. du Trachôme, 1932, v. 9, Jan., p. 47.

In an attempt to determine a relationship between trachoma and tuberculosis, Janawoska examined 500 cases of tuberculosis in the hospitals of Kiew. Five were found to have trachoma and in these the disease was of long standing. Inspection of a large number of tuberculous infants revealed no case of trachoma. As the trachoma index for the city of Kiew is one percent it would seem that no relationship exists between trachomatous and tuberculous disease.

*Phillips Thygeson.*

Longchamp, J., and Reboul, J. **Four cases of Parinaud's conjunctivitis.** Arch. d'Opht., 1932, v. 49, Feb., p. 88.

In all four cases reported the patients had been in contact with animals. The unusual feature was the appearance of four cases of this rare condition in the same region within one month's time. The idea is advanced that a filterable virus may be responsible for the disease, but the writers were unable to make inoculations to confirm this hypothesis.

*M. F. Weymann.*

Michail, D., and Vancea, P. **Some experimental facts in trachoma.** Rev. Internat. du Trachôme, 1932, v. 9, Jan., p. 33.

These authors have performed on blind eyes a rather large series of experimental inoculations with trachoma virus. They have obtained the typical disease by light massage of the inferior cul-de-sac, previously scarified, with fragments of trachomatous conjunctiva, or with follicular material obtained by expression. In eight cases so treated they obtained an acute diffuse conjunctivitis after an incubation period of from five to seven days, followed in four or five days by the appearance of typical follicles. Three weeks later the appearance was that of subacute florid trachoma. The authors consider the acute symptoms at the onset as characteristic of experimental trachoma, distinguishing it from the natural disease in which a chronic evolution is the rule.

They consider that the conditions of inoculation probably account for the difference.

A ninth case was inoculated under the conjunctiva of the lower cul-de-sac by injection through the lid, thus avoiding all contact with the epithelium. As no disease resulted after two trials the authors feel that direct contact with the conjunctival surface is necessary for infection. This same case was later inoculated by the usual method, and eight days later a diffuse acute conjunctivitis appeared which continued three weeks without production of typical granulations. This atypical form of infection is considered as possibly resulting from mild local immunity produced by the previous negative inoculations.

The authors also studied two cases of monocular trachoma in which they inoculated the healthy eye with scrapings from the diseased one. In no instance did infection occur. This same material was inoculated on the normal conjunctiva of two blind persons without producing disease. Inoculation with virus taken from typical cases of bilateral trachoma readily produced infection. This result suggests to the authors that what is ordinarily considered monolateral trachoma may in reality be a separate disease which simulates trachoma.

*Phillips Thygeson.*

Morax, V. **Diplobacillary infection.** Ann. d'Ocul., 1932, v. 169, Feb., pp. 81-93.

The author formerly believed that the diplobacillus was strictly localized in the region of the conjunctiva, but he now brings evidence that the organism may be found on the nasal mucosa and the mucous membrane of the lips. Experimentally it has never been possible to reproduce the infection in animals. A chimpanzee in his laboratory developed spontaneously a conjunctivitis that simulated the human disease. The organism proved to be the diplobacillus but failed to infect other chimpanzees. In the first animal zinc sulphate solution promptly cured the condition.

*H. Rommel Hildreth.*

Peshkin, M. M. **A dry-pollen ophthalmic test in pollen asthma and hay fever patients negative to cutaneous tests.** Jour. Allergy, 1931, v. 3, no. 1, Nov., p. 20.

After reviewing the literature, the author describes his dry pollen ophthalmic test, used in those cases of typical pollen asthma and hay fever in which the skin sensitization tests are negative. Dry pollen is used instead of a diluted pollen extract. A small quantity is placed in the lower conjunctival sac. The patient closes the eye. At the end of five minutes, the pollen residue is removed from the eye with an applicator. Five minutes later, the reaction is noted and adrenalin instilled. The test can be performed daily.

The positive reactions are reported as one, two, three, and four plus. In a one-plus reaction, the conjunctiva is moderately congested and the sclera moderately red. The caruncle is only slightly reddened. In a two-plus reaction, the redness of the conjunctiva and sclera is more diffuse and the caruncle is moderately swollen and red. A three-plus reaction is similar except that the redness is more intense. In a four-plus reaction, there is chemosis of the sclera, conjunctiva, and caruncle of varying degree. There may be a delayed reaction which makes its appearance in from twelve to twenty-four hours.

The ophthalmic test should never be performed when the scratch test is positive. Patients with vernal conjunctivitis should not be tested during the pollen season because of the danger of aggravating the disease. The test should not be attempted on an inflamed eye.

*M. E. Marcove.*

Peters, A. **The histology of trachoma (lattice fibers).** Klin. M. f. Augenh., 1932, v. 88, Feb., p. 145. (Ill.).

Lattice fibers are systems of reticular fibers of connective tissue in the lymphatic glands and lymphoid tissue, described by Maximow, Rössle and Yoshida, and differing from the elastic fibers. Peters found them in the retro-tarsal fold in chronic trachoma and in

acute trachoma with marked follicles. They were crowded around the follicles, scanty in their interior, and abundant in a layer between follicles and epithelium. Their occurrence in the adenoid tissue and its surroundings suggests that they must favor cicatrization as shown in sclerotic processes in the lymphatic glands and the liver, and also by the fact that there is no better means of preventing cicatrization than removal of the adenoid tissue by scraping and expression. *C. Zimmermann.*

Pillat, A. **A peculiar pigmentation of the conjunctiva in the different forms of disease due to deficiency of vitamin A in adults.** Graefe's Arch., 1931, v. 127, p. 575.

In a large number of adults with diseases caused by deficiency of vitamin A, there occurs a more or less definite pigmentation of the conjunctiva which may be overlooked in mild cases and when pronounced may be confused with an argyrosis. The conjunctiva in cases not complicated by inflammation is light gray to a dark grayish-brown. The pigmentation is greatest in the region of the inner canthus including the plica semilunaris and the caruncle, becomes less intense in the lower fornix, the conjunctiva of the lower lid, the conjunctiva of the eyeball, and lastly in the conjunctiva of the upper eyelid and the upper fornix. Observation of the pigment with the slitlamp shows that it is deposited in the epithelium.

This pigmentation is rarely absent in cases of keratomalacia; it is very frequent in xerosis of the conjunctiva (Bitot's spots) and of the cornea, in prexerosis and in night blindness of long duration. It is not a late sign of vitamin-A deficiency but occurs comparatively early. The pigment slowly disappears from the conjunctiva with a diet rich in vitamin A, particularly after treatment with cod-liver oil. Although it is much more distinctly developed in the pigmented races (Chinese), it does occur also in Europe from a deficiency of vitamin A.

*H. D. Lamb.*



Sédan, Jean. **Treatment of trachoma with Jacobson's solution.** *Rev. Internat. du Trachôme*, 1932, v. 9, Jan., p. 41.

In several cases of trachomatous pannus, unaffected by ordinary methods of treatment, Sédan obtained decided improvement by intramuscular injection of Jacobson's solution twice weekly. Definite improvement was noted after twelve injections. *Phillips Thygeson.*

Sédan, Jean. **The use of nascent silver iodide in ophthalmology.** *Ann. d'Ocul.*, 1932, v. 169, Feb., pp. 137-140.

The author found this remedy, made by mixing of potassium iodide and silver nitrate solutions, especially advantageous in the treatment of trachoma and purulent conjunctivitis. No corneal complications occurred in a series of 300 cases.

Two solutions are prepared, one of potassium iodide (3.32 gm. to 10 gm. distilled water), and the second of silver nitrate (3.56 gm. to 10 gm. distilled water) and kept in separate colored flasks. With glass rods a drop of each is taken, the two mixed and applied to the lower cul-de-sac.

*H. Rommel Hildreth.*

## 6. CORNEA AND SCLERA

Addario la Ferla, G. **Two cases of tetanus from traumatism of the cornea, one ending fatally.** *Lettura Oftalmologica*, 1931, Jan., p. 10.

The author describes two cases of tetanus infection provoked by corneal trauma. The first case showed a large septic corneal ulcer with hypopyon; the other a perforating ulcer of the cornea with endophthalmitis. Corneal ulcer with hypopyon was present in a man of sixty-three years, being first observed eight days after the injury. On the twelfth day, two days after administration of antitetanic serum, the patient died after the paralysis common to tetanus cases had set in. In the second case, a girl aged seven years, developed endophthalmitis following a penetrating corneal injury. Three days after injury symptoms of excitability ap-

peared in the form of insomnia and spasms in the arm and leg muscles. Antitetanic serum was administered, and the next day these symptoms disappeared. The child made a complete recovery, retaining an atrophied eyeball.

*F. M. Crage.*

Addario la Ferla. **The value of division of the perilimbal conjunctiva, and a new surgical method against trachomatous pannus.** *Lettura Oftalmologica*, 1931, Feb., p. 74.

The author describes a new surgical means of treating thick trachomatous pannus. It is used preferably in the vascularized type which does not respond to peritomy, peridectomy, or medical measures. The operation is a modification of the Steiner method for false pterygium. The conjunctiva, locally, over a considerable area, is incised as in peritomy. The conjunctiva and the episcleral tissue are dissected back as far as the fornix. This space becomes deepened and the freed conjunctiva is reflected back so that it rests in the deepest part of this portion of the conjunctival sac. The free edge of the conjunctiva is anchored here by one or two Snellen sutures emerging externally through the lid. The bared portion of sclera becomes covered by new epithelium. When the entire cornea is affected, the same maneuver is employed inferiorly and at the angles.

Remarkable disappearance of the pannus was noted in a number of severe protracted cases, including one so severe that canthoplasty and partial tarsectomy had to be done as a primary procedure.

*F. M. Crage.*

Derer, J. **Treatment of ulcer serpens corneæ with ultraviolet light.** *Oft. Sbornik*, 1931, v. 6, pp. 102-106.

The author reports 101 ulcers. In addition to the regular treatment, ultraviolet rays were used in fifty-seven of the cases. The cases were divided into three groups, according to symptoms and severity. In slight and moderately severe cases, the ultraviolet rays were an asset in treatment, in severe and

advanced ulcers no better results were obtained than with the usual treatment.

*G. D. Theobald.*

Klauber, E. **Treatment of ulcers and infiltrations of the cornea with gold chloride.** *Klin. M. f. Augenh.*, 1932, v. 88, Feb., p. 225.

Klauber had good results from treatment of small serpent and rodent ulcers of the cornea with five percent gold chloride solution. Five clinical histories are included.

*C. Zimmermann.*

Lando, M. X. **Tuberculous scleritis.** *Boletin de Informacion Oft.*, 1931, May-June, p. 137.

This author deplors the present day inclination to classify most cases of etiologically undetermined scleritis under the rheumatic group. He believes that many of these are cases of tuberculous origin. Four such cases are reported which were treated and cured with tuberculin injections.

*Hugo Lucic.*

Löwenstein, Arnold. **Consideration of a case of traumatic swelling, with remarks on the significance of the corneal endothelium.** *Graefe's Arch.*, 1931, v. 127, p. 598. (See Section 16, Injuries.)

Montalti, M. **Actinotherapy in chronic sclerokeratitis.** *Lettura Oftalmologica*, 1931, Feb., p. 85.

The case observed and treated by the author was one of recurring sclerokeratitis in a healthy female aged thirty-four years. The first attack had occurred five years previously. Iodin and local treatment had failed to benefit except for very short periods.

The lesion consisted of a congested nodular tumefaction the size of a pea, situated at the limbus in the superior nasal quadrant. There was a coexisting interstitial keratitis in the adjacent cornea. A foreign body sensation, photophobia, and moderate lacrimation were complained of. The Wassermann and cutaneous reactions were all negative. X-ray examinations showed hilus adenopathy. Seven local and five gen-

eral treatments of quartz light were administered. Improvement began with the second irradiation. After four months nothing remained except a small leucoma at the site of the original lesion. The case was considered to be of a tuberculous nature.

*F. M. Cragg.*

Morax, V. **Swimming pool conjunctivitis.** *Rev. Internat. du Trachôme*, 1932, v. 9, Jan., p. 8.

Morax reviews the literature on swimming pool conjunctivitis with special reference to the inclusion bodies of Halberstaedter and Prowaczek. Certain authors have stated that these bodies are always present and that this disease should be classed with inclusion blennorrhea of the new-born and of the adult. Others state that inclusions are only rarely present. One author divides the disease into two types: those cases in which one finds inclusions he classifies as genital trachoma, and those in which inclusions are absent, which he considers due to a separate infection whose etiology is unknown.

Since 1929 Morax has studied fourteen cases of follicular conjunctivitis having the clinical symptoms of swimming-pool conjunctivitis. Ten of these apparently contracted their infection in pools, while the other four, having identical symptoms, had never frequented the public baths. Morax found scattered inclusions in one of the ten swimming pool cases, and numerous inclusions in one of the other four cases. He concludes that since the true nature of the Halberstaedter-Prowaczek bodies is still unknown, it is better at present to rely on clinical observation for diagnosis of the disease. There is no reason to confuse this condition with trachoma, since the evolution and prognosis of the disease are entirely different.

*Phillips Thygeson.*

Nyulassy, S. **Periectomy or Denig's operation.** *Oft. Sbornik*, 1931, v. 6, pp. 107-109.

The author performed periectomy in seventeen cases and Denig's operation (combined periectomy and mucous membrane transplant) in nine cases of

trachoma with pannus. He reports one to six lines of improvement in vision. (Note: This cannot be accepted as a final report because enough time has not elapsed, some of the author's cases being operated on only three months before the paper was written.)

*G. D. Theobald.*

**Sondermann, R. and G. Trephining of the cornea in serpent ulcer and other eye diseases.** *Klin. M. f. Augenh.*, 1932, v. 88, Feb., p. 183.

The authors report on ninety-three cases of serpent ulcer treated by trephining the cornea with a 1 or 1.5 mm. trephine. The main point of interest was the immediate good result. Determining indications are central location and the size of the ulcer. It is most important not to wait too long with the operation. Other kinds of corneal ulcer were also successfully treated by trephining. The advantages derived from abolition of the anterior chamber—including better blood circulation, formation of antibodies, and putting the eye at rest—led the authors to trephine the cornea in affections of the uvea and retina. In nine cases of serous iridocyclitis this proved a valuable supplement to the usual therapy. In the acute stages of tuberculous processes, however, it is contraindicated. *C. Zimmermann.*

#### 7. UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

**Poos, Fr. The histologic and clinical findings in acute local disturbances of the circulation in the capillaries of the eye.** *Graefe's Arch.*, 1931, v. 127, p. 489.

Every irritation causing an inflammation produces an atony of the capillaries. Every acutely arising capillary paralysis leads to maximal dilatation and the expression of colloid through the vessel wall. Using a large number of rabbits, many experiments with physical irritation (paracentesis for the trauma of diminished tension), overstretching, contusion (for the trauma of hypertension), chemical irritants (local application of substances toxic to the capillaries, as adrenalin and cocaine)

and irritations chiefly to the nerves (cauterization at the limbus and paralysis of the sympathetic innervation) produced a functional injury to the capillaries and thereby a local insufficiency of the circulation with the histologic signs of inflammation. Expulsion into the tissue of blood plasma foreign to the tissue is considered as the chief factor upon which depend the other changes in the blood stream and in the tissue. By injection of the second and third aqueous humors into the vitreous or under the conjunctiva, a toxic action upon the vessels could be demonstrated due to the albuminous substances of the blood present in the injected aqueous. The toxic effect of albuminous edema, as for example in the ciliary processes, is also the essential cause of massive (chemotactic) infiltration with leucocytes.

The toxic inflammatory effects upon the capillaries were histologically studied after application of sodium chloride, grape sugar, dionin, histamin, erythrophlein, ergotamin, adrenalin, cocaine, ephedrin, atropin, homatropin, scopolamin, pilocarpin, eserine, and insulin. The mildest action of these substances upon the intraocular vessels was brought out by the oxydase reaction in sections of the excised eyeballs. In the case of all irritants affecting the capillaries, there was noted an initial increase of ocular tension of brief duration, followed by a phase of hypotony persisting for a longer time. The primary increase of tension is the result of the expulsion of albumen from the vessels into the tissue and into the aqueous humor. The ocular tension soon falls because with this stasis in the surrounding tissue fluids the local blood pressure in the capillaries falls.

*H. D. Lamb.*

**Roscin, W. The etiology of vesicular detachment of ciliary epithelium (Greeff).** *Klin. M. f. Augenh.*, 1932, v. 88, Feb., p. 216.

The author undertook two series of experiments for deciding these two questions: (1) Is stimulation of the sensory nerves of the eye an uncondi-

tional requirement for development of the vesicles of Greeff, or may they develop without reactive hypertony of the eye. (2) May they be produced by indirect influences, remote from the eye, upon the vessels of the ciliary body. The microscopical changes showed that, if used during deep narcosis of the experimental animals, subconjunctival injection of hypertonic salt solution, cauterization of the limbus, or strong blows on the eyeball did not elicit Greeff's vesicles. This supports the assumption of Leplat and Samojlov that the preservation of the sensory nerves of the eye is a *conditio sine qua non* for genesis of the vesicles.

In all the other experiments (evacuation of the anterior chamber, partial drainage of the vitreous, compression of the eyeball with a weight, ligature of the vorticoses veins) deep narcosis did not prevent edema of the ciliary processes or the formation of Greeff's vesicles. Hence the vesicles may originate from any sufficiently great hyperemia of the ciliary body.

After extirpation of the upper cervical ganglion in another series of experiments, Greeff's vesicles were always encountered if enucleation was performed within four days. The author concludes that any arterial and venous hyperemia of the ciliary processes may be associated with formation of Greeff's vesicles. Painful excitation of the eye is not absolutely necessary for their development, as it is only a partial element in the whole complex of phenomena which may create ciliary hyperemia and the vesicles.

*C. Zimmermann.*

Sabata, J. **Gray cataract in heterochromia.** *Oft. Sbornik*, 1931, v. 6, pp. 100-101.

A prematurely gray, bent, and senile man of thirty-one years presented himself at the clinic in May, 1930. The left eye was normal with blue iris. Eight years previously he had noticed a gray mist in front of the right eye. For the past three years this eye had had only light perception and projection. The iris was light gray, atrophic. The slitlamp

showed fine pigment granules on the posterior surface of the cornea and floating in the anterior chamber; the iris in process of depigmentation; the lens diffusely gray, with a pinkish-gray reflex at the periphery.

After combined extraction the wound healed by first intention, the fundus was negative, the pigment disappeared from the anterior chamber, and correction gave vision of 6/6.

*G. D. Theobald.*

#### 8. GLAUCOMA AND OCULAR TENSION

Hrankovicova, Lucia. **Secondary glaucoma following cataract extraction.** *Oft. Sbornik*, 1931, v. 6, pp. 95-99.

At the Bratislava clinic, during a ten-year period, there were twenty-nine cases of secondary glaucoma following extraction in 2,500 cases of senile cataract. The author gives the known anatomical causes as: (1) prolapse of iris in the operative wound. (2) Hemispheric arching forward of the vitreous which through pressure on the iris, or through irritation of the ciliary body, caused an increase of intraocular tension. The cases of unknown etiology she regards as primary chronic simple glaucoma. Various operative procedures gave good results, especially cyclodialysis. Vision in twelve cases was between 6/6 and 6/60. Practical vision was retained in four cases. In the remaining cases, vision was bad before the onset of glaucoma. The author feels that glaucoma following cataract extraction is a benign condition and that with the proper intervention vision can be preserved.

*G. D. Theobald.*

Larsson, Sven. **The intraocular vessels of the anterior segment and their influence on ocular tension.** *Ann. d'Ocul.*, 1932, v. 169, Feb., pp. 94-119.

The superficial capillaries and the sphincter vessels of the rabbit iris are altered by a variation in illumination when studied with the slitlamp. At the same time an accurate idea of pupillary responses may be obtained. By the optical activity of the aqueous beam one may detect variations in the albumen



content of the aqueous. Finally, it is possible to see narrow shadows of the ciliary processes behind the posterior surface of the iris. With modifications, these four subjects are studied in relation to intraocular tension while the eye is subjected to different external influences. The report of the experimental work does not lend itself to abstraction. (Four plates, seven graphs.)

*H. Rommel Hildreth.*

Schmelzer, Hans. **Clinical observations on the effective principle of remedies to reduce intraocular tension; erythrophlein and nervocidin.** Graefe's Arch., 1931, v. 127, p. 646.

The subject was a sixty-year-old man with glaucoma simplex in both eyes. Observations were made on the unoperated left eye, whose tension in ordinary room light was 22 mm. Hg with a pupillary diameter of 4 mm. After a stay of one hour in the dark, the tension rose to 48 mm. Hg, with a pupillary diameter of 7 mm. in this eye. Curves were plotted of the tension and pupillary diameter for each hour following a sojourn in the dark, first with the eye untreated and then before and after instillation of 2 percent pilocarpin, 1 percent homatropin followed by  $\frac{1}{4}$  percent eserine, 10 percent cocaine followed by 1 percent pilocarpin, 5 percent cocaine followed by 2 percent pilocarpin, 2 per thousand nervocidin, and 2 per thousand erythrophlein. Nervocidin and erythrophlein were found to produce practically no diminution of ocular tension.

*H. D. Lamb.*

Weekers, L. **Experimental ophthalmotonic reactions by puncture of the ciliary body.** Arch. d'Opht., 1932, v. 49, Jan., p. 24.

Attention is called to the experiments of Pesme and Duthil, who found an immediate drop in intraocular tension after puncturing the ciliary body through the sclera with a fine needle. They attributed this to uveal vasoconstriction. In repeating these experiments Weekers found that no matter how fine a needle was used there was an escape of aqueous, which would account for the sudden hypotony. The

fluorescein test also showed that vasodilatation existed with increased permeability of the ciliary body. The author concludes that disturbances of the ciliary body produced by puncture follow the general rules laid down by him as applying to experimental traumatism of other types. If the traumatism is severe there is a preliminary rise in tension followed by a prolonged period of hypotony. If the injury is less severe the preliminary rise may be negligible and there is recorded only an ensuing period of lowered tension.

*M. F. Weymann.*

Zanettin, G. **Behavior of central and peripheral light sense in simple chronic glaucoma.** Ann. di Ottal., 1931, v. 59, Sept.-Oct., p. 847.

In studies made in seventeen eyes of persons suffering from chronic simple glaucoma; the light sense was found more frequently reduced proportionately in the region of the macula than in the periphery. The zone oftenest and earliest affected was in the temporal sector, then followed in order the superior, the inferior, and finally the nasal sector. The diminution of retinal sensibility was in close relationship to the condition of atrophy of the optic nerve fibers and consequently to the visual field but the limitation of the field did not depend exclusively on the atrophy. Intraocular tension contributed to diminution of the light sense and was of the greater importance the longer the pressure was maintained on the retina and the optic disc. The Lo Cascio photometer was employed and the symptom of modification of the light sense is regarded as one of the earlier symptoms of the disease. The value of the work of Waite, Herbert, Derby, and Kirk as interpreted through German sources is recognized by the author.

*Park Lewis.*

#### 9. CRYSTALLINE LENS

Cattaneo, D. **Raynaud's disease and cataract.** Arch. di Ottal., 1931, v. 38, Dec., p. 684.

Our actual knowledge of the etiology and pathology as well as of the pathogenesis of this disease warrants the con-

clusion that the disturbance in the nutrition of the lens is closely related to that of the entire organism and that its medical care must be general in character. Raynaud's disease is characterized by endocrine imbalance. In the case recorded, that of a woman of forty-seven years, the first phalanx of the index finger had become gangrenous but had healed leaving the joint white and thin. The general symptoms were characteristic of the disease. Cataract had already developed in both eyes. After excluding congenital, senile, and dyscrasic origins the author concludes that the location of the opacities and their form are due to angiociliary spasm and result directly from the constitutional disease. While the presence of a characteristic vagotonia or sympathicotonia with the hypofunctioning or hyperfunctioning of any special endocrine gland cannot be established, there is strong probability that disturbed action of the hormones causes a ciliary angiospasm like in character to that affecting the extremities. This is the first case in which cataract is described as a feature of Raynaud's disease. (Bibliography.)

*Park Lewis.*

**Cirincione, G. Leaves from an unfinished treatise on ophthalmology. Diseases of the crystalline lens.** *Ann. di Ottal.*, 1931, v. 59, Sept.-Oct., p. 769. (See *Amer. Jour. of Ophth.*, 1932, v. 15, March, p. 257.)

The continuation of this subject treats of the varieties of cataract encountered, their etiology, the preparation of the patient and of the instruments, accidents which may happen, and so on. This article adds thirty-four pages to the eleven on cataract given in the previous number, making in all forty-five pages devoted to this subject.

*Park Lewis.*

**Derer, J. Operation of senile cataract, with special reference to intracapsular extraction.** *Oft. Sbornik*, 1931, v. 6, pp. 69-81.

During a five year period, 444 cataracts were removed by the following methods: 243 combined iridectomy and

capsulotomy, 131 simple capsulotomy extraction according to Hess's method, 70 intracapsular. For anesthesia, retrobulbar injections of novocaine and adrenalin were used. Derer gives the following results:

1. Combined extraction, 96 percent favorable result, with vitreous prolapse in 7.4 percent; iris prolapse in 2.87 percent; discission in 5 percent. There were four infections, one endogenous iritis, one infection after discission, one explosive hemorrhage.

2. Hess's method 100 percent, with prolapse of vitreous in 1.5 percent; iris prolapse in 0.76 percent. There was no loss, or infection.

3. Intracapsular, 95.71 percent favorable result, the remainder questionable with less than 3/60 vision. Vitreous prolapse in 2.85 percent and iris prolapse in 5.71 percent. There was no complete loss.

The author prefers the Hess method. The one disadvantage of the intracapsular method is that postoperative complications are more liable to occur than after other extractions. This method of operation is suitable for quiet reliable patients and is only for use in institutions with good nursing facilities. The relatively bad results of the combined capsulotomy operation cannot be solely attributed to the method, but also to the fact that all restless, unintelligent, senile, and imbecile patients are operated on by this method. In eighteen well-controlled patients, both eyes were operated on simultaneously with good results.

*G. D. Theobald.*

**Gala, A. Contribution to the treatment of postoperative complications after cataract extraction.** *Oft. Sbornik*, 1931, v. 6, pp. 88-91.

For the treatment of postoperative complications such as iris prolapse and cyst formation at the site of the wound, the author finds electrocoagulation the most efficient. It is the method of choice, which in suitable cases gives the maximum result and is the simplest intervention. He reports six cases treated by this method. (Bibliography.)

*G. D. Theobald.*

Hrankovicova, Lucia. **Secondary glaucoma following cataract extraction.** Oft. Sbornik, 1931, v. 6, pp. 95-99. (See Section 8, Glaucoma and ocular tension.)

Mrazova-Tregerova, Irene. **Comparison of the results of intra- and extracapsular extraction of senile cataract.** Oft. Sbornik, 1931, v. 6, pp. 82-87.

The author compares the results in 220 intracapsular and 220 extracapsular extractions.

Prolapse of the vitreous and iris are not more frequent in the intracapsular method, nor are adhesions of the root of the iris more frequent than in extracapsular extraction. These adhesions are due to inflammatory changes at the site of the wound. On account of the quiet postoperative course and the subsequent good vision, the author thinks it always worth while to begin the operation according to the intracapsular method, and to do capsulotomy only when intracapsular extraction fails.

G. D. Theobald.

Sabata, J. **Gray cataract in heterochromia.** Oft. Sbornik, 1931, v. 6, pp. 100-101. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Spratt, C. N. **The pocket flap. The safest method for extraction of senile cataract.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1931, p. 96.

A horizontal incision, from 1.5 to 2 cm. long and 5 mm. above the limbus, is made in the conjunctiva, and this structure is dissected down to the limbus, the upper two-fifths of the corneal circumference being freed. A mattress suture is placed in the center of the conjunctival wound edges. Fixation is by the conjunctival flap. The incision is made at the limbus, both puncture and counterpuncture being subconjunctival. If the case is complicated by glaucoma a Lagrange sclerectomy may be done at the time of the corneal section. The advantages claimed for the author's method are that it provides the least chance for infection, there is less dan-

ger of vitreous prolapse, the suture promotes tight union; healing takes place in a few hours, the patient may sit up immediately after the operation, and the period of hospitalization is shortened. The results of 196 extractions by this method are analyzed and tabulated. (Five figures. Discussion.)

George H. Stine.

Tarkington, Booth. **Out of the dark.** The American Magazine, 1932, April, p. 48.

This is a straightforward and sympathetic account of the author's experience in gradually becoming blind from the development of cataract in both eyes; two-stage extracapsular extraction on the first eye, with secondary needling; a remote "complication" possibly in the nature of retinal detachment, and leading to final loss of vision of the first eye; and subsequent recovery of vision from operation on the second eye.

W. H. Crisp.

Vancea, P. **Spontaneous absorption of cataract.** Arch. d'Opht., 1932, v. 49, Feb., p. 78.

Up to the present time about seventy to eighty cases of spontaneous absorption of cataract have been reported. Two additional cases are added to the list, one of which showed partial and the other complete absorption of a congenital cataract. Both of these patients had vagotonia, eosinophilia, and hypcholesterinemia. As a result of experimental work with naphthalin cataract it has been found that insulin accelerates its absorption. The hypervagotony of the patients here reported upon was interpreted as due to a hyperfunction of the pancreas, which would produce a hyperinsulinemia and so favor absorption of the cataract. From his clinical observations and experimental work, Vancea believes that pancreatic hypofunction tends to produce cataract, while hyperfunction will produce conditions favorable to its absorption.

M. F. Weymann.

#### 10. RETINA AND VITREOUS

Arruga, H. **Gonin's operation in the treatment of retinal detachment.** Ars

Medica (Barcelona), 1932, 8th year, Jan., pp. 1-10.

So much has been written on this subject that the present article is mentioned here particularly on account of its exceptionally beautiful series of color illustrations, twenty-four in number, all of which display retinal tears or holes. In some instances the drawings were made after application of the electrocautery.

As a literary curiosity it may be mentioned that the author's conclusions are given in Catalan as well as in Spanish, French, and English. *W. H. Crisp.*

Deutschmann, R. **Inhalation therapy with nitrite of amyl.** Klin. M. f. Augenh., 1932, v. 88, Feb., p. 168.

Discussing the favorable experiences of Imre as to treatment of affections of the fundus with nitrite of amyl, Deutschmann refers to his article in Graefe's Archiv in the year 1881, entitled: "Amblyopia with pale disc and narrow retinal vessels cured or very much improved by inhalation of nitrite of amyl". His observations on the three reported cases encouraged further attempts with nitrite of amyl as a remedy in affections of the optic nerve in which disturbances of circulation in the retinal vessels, especially arterial ischemia, are found as etiological factors.

*C. Zimmermann.*

Goldstein, I., and Wexler, D. **Eyes of irradiated human embryos:** Arch. of Ophth., 1932, v. 7, March, pp. 434-439.

The authors have attempted to continue work which showed conversion of large portions of the retina into rosettes and poorly differentiated tissue, combined with failure of fusion of the layers of the optic stalk, and retardation of development of the ciliary processes and iris, following irradiation of human embryos during the second month of pregnancy. The cases herewith reported point to the origin of the rosettes from the nuclear layers, and not from the neuroepithelium, as previously supposed. In addition, the effect of a hemorrhage in the sheath of the optic nerve of a six and one-half month embryo is

reported, especially the poor resistance which the immature tissue offered to the presence of the hemorrhage. Apparently the rosettes thus produced in the anterior layers, independent of formed neuroepithelium and cone cells, are due to scattering of cells from the nuclear into the forward layers of the retina as a result of the action of the roentgen rays. *M. H. Post.*

Haessler, F. H., and Squier, T. L. **Measurements of retinal vessels in early hypertension.** Arch. of Ophth., 1932, v. 7, Feb., pp. 280-284.

Studies were made to demonstrate the relative change in caliber of the retinal veins and arteries during the administration of amyl nitrite. Photographs were taken with the Zeiss-Nordensen camera. The first exposure was made when the constant blood pressure level was reached and the minimum pressure recorded. Amyl nitrite was then inhaled and the second exposure was made at the moment of maximum fall in pressure, and the minimum pressure again recorded. Positive prints were measured. The method was relatively accurate, but no evidence could be found that such measurements were of value. Variability in the arteriovenous ratio in different parts of the same fundus was marked. No correlation was found between the arterial change and the systolic pressure, fall in systolic pressure, or the degree of retinal arteriosclerosis indicated by tortuosity in the vessels. Tortuosity of the vessels appeared, however, to be of greater importance in retinal arteriosclerosis than changes in caliber. The authors recommend semi-annual photographs to determine such changes in tortuosity. *M. H. Post.*

Kirby, D. B. **The anterior vitreous in health and disease.** Arch. of Ophth., 1932, v. 7, Feb., pp. 241-258.

There is evidence to prove that a condensation layer limits the vitreous anteriorly. The author believes the so-called hyaloid membrane is directly behind the lens. This layer does not correspond to the requirements of struc-



tureless membranes as seen by polarized light. It must be only a mesh of ultramicroscopic fibrils more dense in formation than the balance of the vitreous.

The slitlamp beam shows an irregular fibrillar layer in apposition with the posterior lens capsule. It also shows the arc line of attachment of the hyaloid artery to the anterior condensation layer, as well as the attachment of the latter to the lens at the ligamentum hyaloidea capsulare. The remnants of the hyaloid artery itself may be differentiated with ease. The canal of Cloquet has been well demonstrated, giving a complete idea of the anterior boundaries so that it can easily be located at the so-called ligamentum hyaloideum capsulare.

Liquefaction of the vitreous manifests itself in the slitlamp picture by absence of a part or the whole of the typical moiré curtains, with mixing of the primary and secondary vitreous, and frequently by loss of the retrolental space and by the fact that newly formed opacities float more freely than in the normal vitreous. The fibrils become more visible and floating bodies immediately back of the lens act as though suspended in a liquid medium.

*M. H. Post.*

Kloess, G. **Formation of bands in the vitreous.** *Klin. M. f. Augenh.*, 1932, v. 88, Feb., p. 161. (Ill.).

The right eye of a boy aged eleven years, with vision of 5/20, presented as congenital anomalies several bands in the vitreous, the main one coming from the disc, and a circumpapillary and epipapillary membrane. Transient impairment of sight six months earlier, with diffuse opacity of the vitreous, was probably due to hemorrhage from rupture of a vascularized band. In the second case the left eye of a woman aged thirty years showed remnants of Cloquet's canal and hyaloid vessels.

*C. Zimmermann.*

Lyster, T. C. **Recurrent retinal hemorrhages.** *California and West. Med. Jour.*, 1931, v. 35, Oct., p. 300.

The literature is carefully reviewed and evidence given that recurrent retinal hemorrhages, especially in young adults, are usually due to tuberculosis. Tubercle bacilli are rarely found in the retinal lesions, but the early active stages have not been studied histologically. Lesions affect the retinal veins and not the retinal arteries. Ophthalmoscopically, the process begins with dilatation and thickening of the veins. Later, an oozing extravasation takes place at one or more points. When the hemorrhages are deep and the exudate extends toward the choroid, there results an atrophy of the choroid which later becomes surrounded with pigment. Recurrent retinal hemorrhages before middle life and when trauma, lues, and focal infections can be ruled out should be considered as tuberculous in origin, and should be given the benefit of the doubt by using specific therapy. The dose of tuberculin should be controlled by the focal reaction and not by the local or constitutional reaction. Four case reports are given.

*M. E. Marcove.*

Messinger, H. C. and Eckstein, A. W. **Retinal hemorrhages after blood transfusion.** *Rhode Island Med. Jour.*, 1931, v. 14, Nov., p. 171.

The authors examined sixty cases in which the retina was examined immediately before blood transfusion and again twelve to twenty-four hours later. The clinical diagnosis was anemia caused by acute hemorrhage in thirty-two cases and chronic hemorrhage in ten. In sixteen there was no history of hemorrhage, but transfusion given for secondary anemia. In two, the transfusions were given for shock. Both the citrate and Unger methods were used, giving about 450 c.c. of blood at a time. Cross agglutination was done in all cases. There were no cases of primary anemia in this series. In none of these cases was there an anaphylactic reaction or bleeding from the kidneys. Of the total sixty cases, fresh retinal hemorrhages were seen in ten. Three patients having a diagnosis of lymphatic leukemia had hemorrhages. Two pa-

tients had carcinoma, one of the stomach and one of the uterine cervix. Of the remainder, one had purpura hemorrhagica, one essential menorrhagia, one incomplete miscarriage, one Banti's disease, and one leiomyoma of the uterus.

*M. E. Marcove.*

Puscariu, Elena. **Observations of rare cases of ocular syphilis.** Arch. d'Opht., 1932, v. 49, Jan., p. 37.

The first patient showed a juxtapapillary retinochoroiditis of the Jensen type in the left eye. The Wassermann reaction was positive. Improvement occurred under antisyphilitic treatment. (It seems to the reviewer that the condition was considered syphilitic purely because the patient had a positive Wassermann reaction. A second patient showed an exophthalmos of the left eye, loss of vision, and orbital edema. The Wassermann was positive. Treatment with cyanide of mercury and iodide of potassium led to complete disappearance of the exophthalmos and recovery of vision to 0.5. The diagnosis was considered to be gumma of the optic nerve. This case is said to be the only one diagnosed in vivo and where restoration of visual function has been obtained.

*M. F. Weymann.*

Villard, H., Dejean, C., and Temple, J. **Three cases of embolism of the central artery of the retina. The rôle of superimposed arterial spasm.** Arch. d'Opht., 1932, v. 49, Feb., p. 72.

Observations of three patients presenting the classical signs of embolus, or more correctly thrombosis, of the central artery of the retina showed that in two cases the administration of

acetylcholine was practically without effect, while in the third a marked improvement in vision was obtained. It was considered in this third case that blocking of the artery was due to a combination of thrombosis and spasm. Relief of the spasm permitted partial reestablishment of the circulation with resultant partial recovery of vision.

*M. F. Weymann.*

Weekers, L., and Hubin, R. **Spontaneous cure of detachment of the retina. What are the possibilities of functional recovery of a detached retina?** Arch. d'Opht., 1932, v. 49, Feb., p. 65.

The possibility of a detached retina recovering its function if reattachment occurs depends upon the underlying cause of the detachment and the length of time that the detachment has existed. In experimental animals one retina which had been detached for two months showed no degeneration, while another showed almost complete degeneration in one month. Spontaneous reattachments of the retina do occur and the amount of visual recovery depends directly upon the degenerative changes which have taken place in the retina and not upon the degree of reattachment. Two patients who had had spontaneous reattachments are reported to illustrate this fact, as one recovered fair vision and the other did not. Before undertaking operative treatment of a detached retina it is necessary to consider its cause, but when operation is decided upon the earlier it is done the better the result will be.

*M. F. Weymann.*

## NEWS ITEMS

New items should reach Dr. Melville Black, 424 Metropolitan building, Denver, by the twelfth of the month.

### Deaths

Dr. Joseph Albert Lassalle, Montreal, Quebec, Canada, aged fifty-nine years, died January 16.

Dr. John Nicholas Coghlan, Portland, Oregon, aged sixty-six years, died March 8, of pneumonia.

Dr. David William Stevenson, Akron, Ohio, aged sixty-six years, died March 29, of heart disease.

Dr. Lloyd Leslie Nelson, Norfolk, Nebraska, aged forty-five years, died February 29, of chronic nephritis and myocarditis.

### Miscellaneous

Under the will of the late William H. Nichols, \$25,000 was left to the Brooklyn Eye and Ear Hospital.

The American Academy of Ophthalmology and Otolaryngology has appropriated \$500 to Columbia University for research in ophthalmology.

Dr. Maggiore, editor of the *Annali di Ottalmologia e Clinica Oculistica*, has written Dr. Park Lewis that the *Annali* would be glad to publish original work of merit from the United States. Such publication would, of course, be in the Italian language.

Three agencies have voluntarily combined to promote relief for persons who are both blind and deaf: The American Foundation for the Blind, the American Association to Promote Teaching of Speech to the Deaf, and the American Federation of Organizations for the Hard of Hearing. Each organization will participate in the study of this double handicap in its own field.

According to a survey recently completed by a committee on special classes of the White House Conference, 5,000,000 children in the United States are handicapped to an extent requiring special attention and education. Of these children 3,000,000 have impaired hearing, 1,000,000, defective speech, and 1,000,000 weak or damaged hearts. 450,000 are mentally retarded, 300,000 crippled, 14,000 blind, and 50,000 partly blind. Of the 14,000 blind only 6000 are being educated and only one-tenth of those who should be in sight saving classes are so enrolled.

The National Society for the Prevention of Blindness, in its annual report, states that blindness due to ophthalmia neonatorum was found to be 7.5 percent in the new admissions to schools for the blind in 1931, a reduction of 73.4 percent since 1907. They also report that of eye accidents in childhood 750 to 1000 occur each year, of which 31 percent are caused by weapons. The society urges improved legislation for the control

of the sale of such hazardous arms in the hands of children. Sight saving classes for school children reached 398 in 1931, but over 4600 more are needed.

Four memorial tablets were unveiled in the McMillan Eye, Ear, Nose and Throat Hospital of Washington University School of Medicine, St. Louis, March 15. A tablet in the Woodruff Eye Clinic was dedicated to Dr. Frederick Eno Woodruff, assistant professor of clinical ophthalmology in the university, who, with his wife, endowed the clinic. The tablet was unveiled by Dr. Woodruff's daughter and an address was made by Dr. Harvey J. Howard, director of the hospital and of the Oscar Johnson Research Institute. In honor of the late Dr. Greenfield Sluder, professor of otolaryngology in the university, 1905-1928, a tablet was unveiled at the entrance of the Sluder Clinic by his son. Dr. Lee Wallace Dean, professor of otolaryngology, gave the address. A tablet in the Shapleigh Ward for Ear Patients was dedicated to the memory of Dr. John B. Shapleigh, professor of otology at Washington University for many years. The ward was endowed by members of his family. Dr. McKim Marriott, dean and professor of pediatrics, was the speaker. Dr. John F. Shoemaker, who died recently, was memorialized by a tablet in the Shoemaker Ward, which he endowed. Dr. Lawrence T. Post unveiled the tablet.

The tenth annual summer graduate course in ophthalmology and otolaryngology will be given in Denver, Colorado, from July 18 to July 30, 1932, under the auspices of the Colorado Ophthalmological Society and the Colorado Otolaryngological Society. A fee of fifty dollars is charged for the course and should accompany application to Dr. Harry L. Whitaker, 1612 Tremont St., Denver. The congress will be held July 22 and 23.

In the reorganization of the School of Medicine of the George Washington University the Department of Ophthalmology has been formed. The department is composed of the following staff: William T. Davis, M.D., professor of ophthalmology and executive officer of the department; George V. Simpson, M.D., assistant professor of ophthalmology; Ernest A. W. Sheppard, M.D.C.M., clinical instructor in ophthalmology; Charles L. Billard, M.D., clinical instructor in ophthalmology; Frederick L. Benton, M.D., Sc.D., clinical instructor in ophthalmology; Ralph Stevens Pendexter, LL.B., M.D., clinical instructor in ophthalmology; William T. Burch, M.D., clinical instructor in ophthalmology.

As noted in the News Item for May, the Colorado Ophthalmological Society on

March 25, 1932, held a dinner meeting, celebrating the thirty-third anniversary of the foundation of the Society, and in honor of Dr. Melville Black, one of its three surviving members, all of whom took part in the meeting for organization, and in this celebration. Two of the charter members, Edmund W. Stevens and David H. Coover, have been removed by death. The first member elected to the Society, Dr. George F. Libby, now resides in San Diego, California, and Victoria, B.C. He sent a letter of sincerest congratulations. Other letters, of congratulation to the Society and personal tributes to Dr. Black, were read by Edward Jackson, from George E. de Schweinitz and William Zentmayer of Philadelphia, John Green and Lawrence T. Post, of St. Louis, Wm. H. Wilder, George F. Suker, Sanford Gifford, and Harry S. Gradle, of Chicago; Roderic O'Connor, of San Francisco, and Wm. D. Donohue, of Salt Lake City, with a telegram from the Utah Ophthalmological Society.

Tributes to Dr. Black were given by William C. Bane and Robert Levy of Denver. Dr. Black told of interesting experiences in the early days of the Middle West; running a drug store, studying medicine, serving as interne in New York hospitals, including two years at the Manhattan Eye, Ear and Throat Hospital, and early teaching of ophthalmology in Colorado.

The scientific address of the evening upon "The nature of light" was given by Professor O. C. Lester, head of the Department of Physics, Dean of the Graduate School, and Vice-president of the University of Colorado. It was illustrated by lantern slides and optical apparatus. It pointed out the observations explained by the wave theory of

light, and others only explained by the so-called quantum theory.

There were present thirty-six members and guests of the Society, among whom were Dean Maurice H. Rees, and former Dean Charles N. Meader, of the Medical School of the University. In the afternoon before the meeting, clinics were given by Drs. Black and Wm. M. Bane doing cataract extractions in the capsule; and by Dr. D. H. O'Rourke, performing the O'Connor cinch operation for muscle shortening. This was the final day of the Annual Spring Clinics at the University Medical School.

A meeting of the College of Physicians of Philadelphia, Section of Ophthalmology, was held on October 15, 1931, Dr. H. Maxwell Langdon presiding. Dr. Vilray P. Blair of Saint Louis, by invitation read a paper on blepharoplasty and ptosis operative procedures. Numerous slides and moving pictures were shown.

#### Personals

Dr. Martin Cohen has been made professor of ophthalmology of the New York Post-Graduate Medical School and Hospital of Columbia University.

Dr. Ignatz Sommer of Vienna gave a fifteen hour course on neurology of the eye and ear at the Illinois Charitable Eye and Ear Infirmary, during the month of May.

We have a letter from Dr. H. B. Young of Burlington, Iowa. He says, "I wonder if I am the oldest practicing ophthalmologist in the United States!" He was graduated in medicine in 1875 and has been specializing in ophthalmology fifty-three years. He is eighty-one years of age. Does anyone wish to contest Dr. Young's claim to being the oldest practicing ophthalmologist?